SCIENTIFIC AMERICAN

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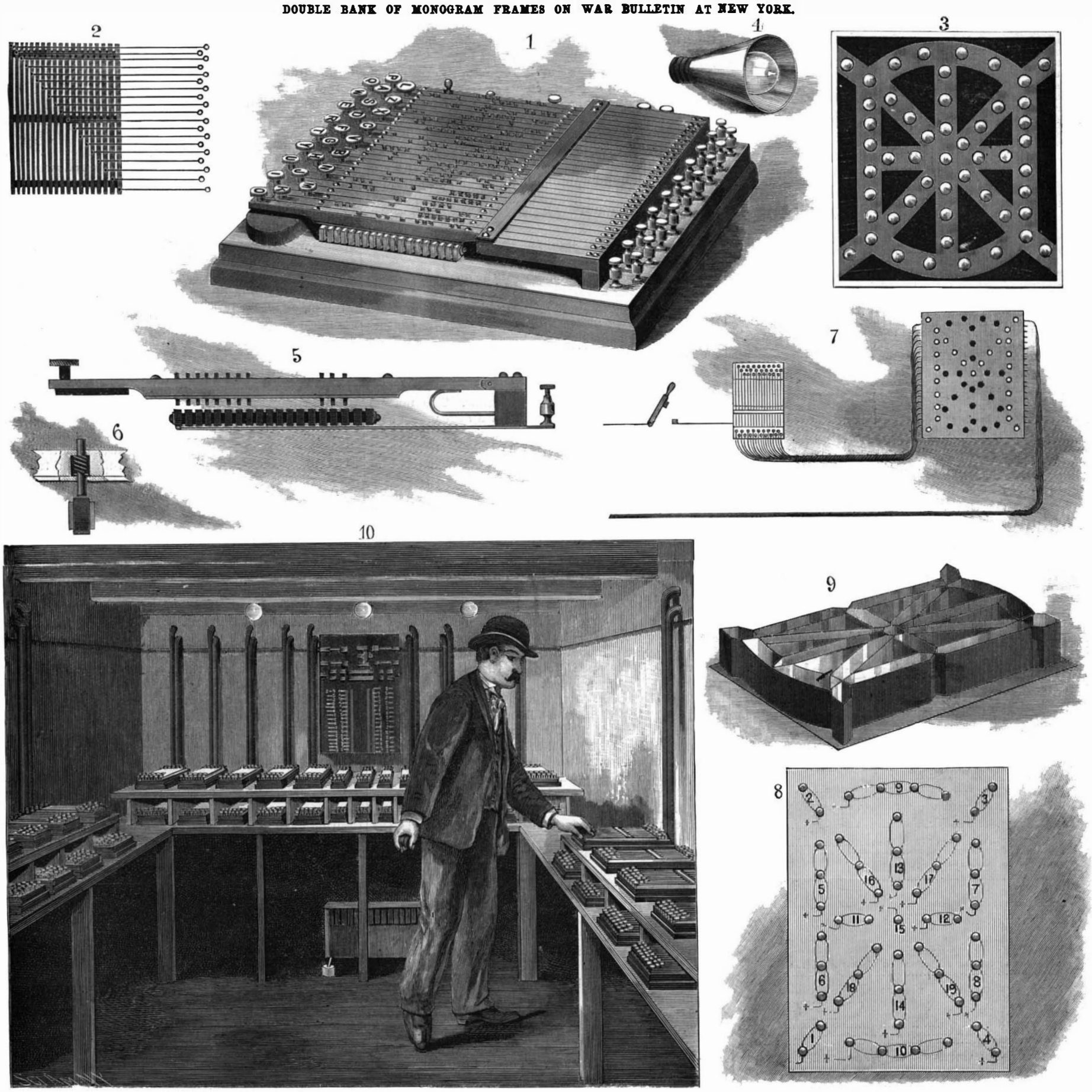
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

Vol. LXXVIII.—No. 23. ESTABLISHED 1845.] NEW YORK, JUNE 4, 1898. [$3.00 A YEAR. WEEKLY.

DOUBLE BANK OF MONOGRAM FRAMES ON WAR BULLETIN AT NEW YORK.



1. A keyboard. 2. Method of wiring the contact bars. 3. A monogram frame. 4. Lamp inclosed in ray-protector. 5. A key, showing contact points and bars. 6. Detail of a contact point. 7. Diagram of keyboard and monogram wiring. 8. System of grouping the lamps. 9. Another form of ray-protector. 10. Interior of operator's room, Madison Square.

NEW SYSTEM OF ELECTRIC SIGNS AND SIGNALS FOR ANNOUNCING WAR NEWS.—[See page 359.]

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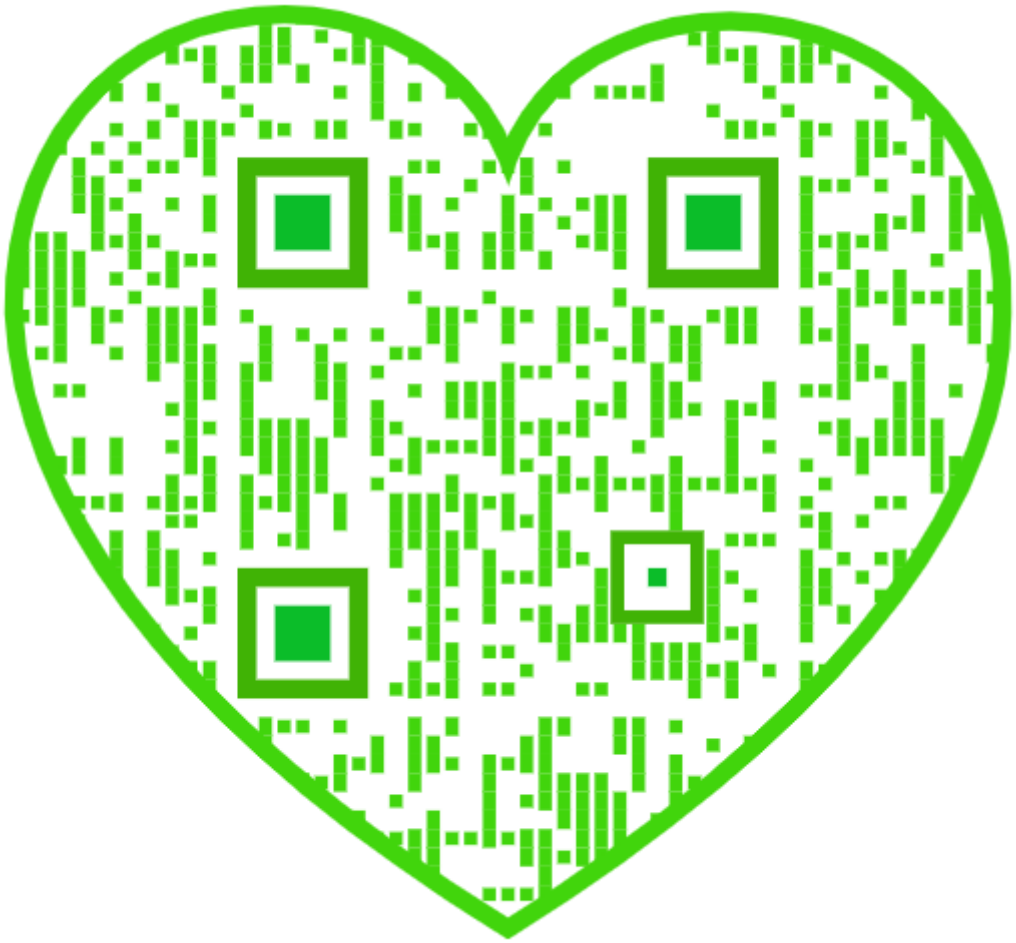

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

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(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....**$3.00**
One copy, six months, for the U. S., Canada or Mexico..... **1.50**
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NEW YORK, SATURDAY, JUNE 4, 1898.

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THE ARMORED CRUISER IN THE NAVIES OF THE WORLD.

The modern warship is the most cosmopolitan product of this essentially cosmopolitan age. Except for a few minor characteristics, which may temporarily distinguish the ships of one nation from those of the rest of the world, there are no broad international differences in naval construction such as we find in the other great branches of industry.

The reason is not far to seek. It is to be found in the fact that each great naval power realizes that it must not only have many ships, but the ships must be the very best possible. The question of naval efficiency is a question of national life and death, and no sentimental objections are now allowed for a moment to prevent a nation from imitating its neighbors and rival in the construction of the latest types of ships, guns and armor. Occasionally, in former years, a nation held on to some inferior and obsolete practice rather than follow the lead of its more progressive rivals, as when some years ago England continued to build muzzle-loading guns when other nations were adopting the breech-loader, and France at a later day refused for some years to follow England's example in the building of rapid-fire weapons; but such conservatism has always cost the nations dearly and has resulted in the conveyance of much costly material to the scrap heap.

Hence it has come to pass that the publication of each year's naval programmes of construction is an event looked for with profound interest by naval constructors, inasmuch as these programmes show conclusively what is the majority opinion as regards the best types of ships to build.

We have taken occasion to read carefully through the lists of the world's navies and note what is the general character of the ships which have lately been built or are under construction or are authorized to be built, and we are impressed with the fact that the coming warship will be of a type between the battleship and the swift armored cruiser, a vessel with heavy battery, medium armor protection, high speed and exceptionally large coal supply.

Two tendencies are noticeable, each of which we as a nation should take special note of. The first is the disposition to build armored cruisers instead of the protected type, the other is the very high speed which is being given to battleships, a speed which in many cases gives to the battleship all the advantages claimed for the armored cruiser.

The following is a statement of the armored cruisers built or building in each navy. We have included no ship of less than 18 knots speed, and it will be noticed that it is only the older ships that are as slow as this; the later cruisers being of 20 knots speed or over. In the British navy there are seven armored cruisers of the Australia type, of 5,600 tons and over 18 knots speed, with a belt of 10-inch armor, and an armament of two 9·2-inch and ten 6-inch rapid-fire guns. The normal coal capacity is 900 tons. There are also under construction four armored cruisers of 12,000 tons, 21 knots, 800 tons coal supply; they will have a 6-inch belt and 6-inch protection for the guns, and an armament of two 9·2-inch and twelve 6-inch rapid-fire guns.

The Argentine Republic possesses two armored cruisers, the "Garibaldi" and the "San Martino," which are sister ships to the "Christobal Colon," of the Spanish navy. They are vessels of 6,840 tons and 20 knots speed, with a 6-inch belt and citadel and an armament of two 10-inch, ten 6-inch, and six 4·7-inch rapid-firers.

Austria-Hungary possesses the "Kaiserin Maria Theresia": 5,270 tons, 19 knots, 4-inch belt, and armament of two 9·4, and eight 5·9 rapid-firers. She is also constructing an armored cruiser of 6,100 tons, 10½-inch belt, and 20 knots speed, to carry the same armament as the vessel just mentioned.

Chile possesses in the "Esmeralda" a remarkable vessel of 7,020 tons, which to a 6-inch belt and extremely powerful battery of two 8-inch rapid-firers, sixteen 6-inch and eight 3-inch rapid-firers adds the high speed of 23 knots an hour. Such a ship, preying upon an enemy's commerce, would prove to be the "Alabama" of her day. Another powerful armored cruiser is being built for this enterprising republic by the Armstrongs, the firm that built the "Esmeralda." This is the "O'Higgins," of which we have lately heard so much. She is of 8,500 tons displacement and 22 knots speed and will carry 1,500 tons of coal. Her belt is 7 inches thick and she carries an armament of four 8-inch rapid-firers, ten 6-inch, four 4·7-inch and ten 3-inch rapid-firers. The 8-inch rapid-firer can fire from three to four shots per minute, so these guns could discharge as many shells per minute as a dozen 8-inch slow-fire guns.

France is already well provided with armored cruisers, and her new ships are to be nearly all of the armored type. The "Charner," "Bruix" and "Treville," of about 4,800 tons and 18·3 knots speed, carry a 3½-inch belt and an armament of two 7·6-inch and six 5·5-inch rapid-fire guns. The "Pothuau," 5,360 tons, 19·2 knots, is armed with two 7·6-inch and ten 5·5-inch guns and has a 3⅛-inch belt. The "Dupuy de Lome," 6,406 tons, 20 knots speed, is completely sheathed from stem to stern and up to the top deck with 4 inches of steel. Her armament is similar to that of the "Bruix." It is in new construction, however, that the French are showing the high value they put upon the armored cruiser type. No less than nine of these vessels, the smallest of which is of 7,700 tons displacement and none of less than 21 knots speed, are either building or proposed. The "Dupleix" and "Kléber," each of 7,700 tons and 21 knots and will carry a 6-inch belt. They will have a battery of ten 6·4-inch rapid-fire guns of great power. The six great ships of the Dupetit Thouars class will be of 9,517 tons and 21 knots speed. They will be armed with two 7·6-inch, eight 6·4-inch and four 3·9-inch rapid-fire guns. They can carry a normal supply of 1,020 tons of coal, in addition to a supply of liquid fuel. Not content with this, the French have laid down a large armored vessel of 11,270 tons, the "Jeanne d'Arc," which is to steam at 23 knots and carry a normal coal supply of 1,400 tons. The armament will consist of two 7·6, eight 5·5 and twelve 3·9 rapid-fire guns, and she will have a 6-inch belt.

Germany is building the "Fürst Bismarck," of 10,650 tons and 19 knots. She is to have a 7¾-inch belt and carry four 9·4, twelve 5·9 and ten 3·4 guns, all, including the 9·4-inch, to be rapid-firers.

Italy possesses two armored cruisers of 6,500 tons and 20 knots speed, which carry a 6-inch belt and an armament of twelve 6-inch and six 4·7-inch rapid-firers; one armored cruiser of 4,583 tons and 19 knots; and she is building two sister ships to the "Christobal Colon" (Spanish), which was constructed in Italy.

Japan is also in the fashion in the construction of two 9,750-ton armored cruisers of 21½ knots speed and a third of 9,436 tons and 21½ knots. The armament of each will consist of four 8-inch rapid-firers, fourteen 6-inch and twelve 3-inch rapid-firers.

It was Russia who a few years ago started the construction of huge armored cruisers by building the "Rurik," of 10,923 tons and 18 knots speed. She has a 10-inch belt and an armament of four 8-inch, sixteen 6-inch and six 4·7-inch guns, all slow-firers, with a maximum coal supply of 2,000 tons. She followed this with the "Rossia," 12,130 tons, 10-inch belt, 20 knots speed and a similar armament, except that it consists of rapid-firers. She also possesses the "Pamyat Azova," 6,000 tons, 9-inch belt and 18·8 knots speed. Two others are authorized, one of 7,800 tons and 20 knots and the other of 12,336 tons and 21 knots speed, and it is reported that the fast 6,000-ton cruiser to be built by the Cramps is to be of the armored type.

Spain, our present antagonist, is relatively by far the strongest in this type of ship of all the nations. She has either built or just about completed nine large and fast armored ships, including the "Carlos V." of 9,235 tons, 2-inch belt, 20 knots speed and armament of two 11-inch, eight 5·5-inch, four 3·9-inch rapid-fire guns; two of the "Christobal Colon" type, of 6,840 tons, 20 knots speed, 6-inch belt and citadel, and armament of two 10-inch, ten 6-inch and six 4·7-inch rapid-firers; and six of the "Vizcaya" type, of 7,000 tons, 20 knots speed, 12-inch belt and armament of two 11-inch and ten 5·5-inch rapid-fire guns.

In general it may be said that the fleets of armored cruisers in the navies of the world, especially those recently laid down or authorized, are characterized by high speed, exceptionally heavy armament, in which the rapid-firer predominates, and great coal carrying capacity. It is evident that this is to be the prevailing type of ship in the cruiser class. The decision to build these vessels, and to build them in large numbers, is evidently unanimous as far as the foreign naval powers, great and small, are concerned. As we have already pointed out, our present building program makes no provision whatever for this type, and unless the defect is remedied at an early date, we are liable to be confronted by a fleet of swift hostile warships, against which we would be powerless to act.

At the same time, prudence suggests that we await the actual conflict between our ships and those of Spain before the supplementary naval bill is passed. The experience gained in such a battle will be of untold value in determining the relative value of the various types of vessels, and the country will be in a far better position to judge of its need a few weeks hence than it is just at present. The armored cruiser, it almost goes without saying, is our most pressing need, and we are glad to note that a bill is now before Congress calling for the construction of several of this type. The same bill, however, calls for a further authorization of torpedo boats and destroyers. The exact value of these small craft has yet to be determined, and this can only be done in the test of a naval fight.

OBSTACLES TO SOUTH AMERICAN TRADE.

We are in receipt of a letter from a correspondent in Tocopilla, Chile, Mr. Juan E. Franz, who complains of the fact that although it is possible to send by postal order any small sums from the Chilean post offices to most of the countries in Europe, "facilities which are very favorable to business," if it is desired to remit small sums to the United States it is necessary either to buy drafts on England or pay excessive premiums for

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exchange and then a surcharge of fifty cents for each draft on New York. "What is the value," our correspondent asks, "of the Pan-American Congress and other bodies for opening trade with the South American republics when one of the most useful mediums to this end (postal facilities) is neglected?" Mr. Franz makes the suggestion that the provision of parcel post and postal order accommodation would remove a serious obstacle to trade, and he is not by any means the only citizen of the South American republics who has complained of the disadvantage under which the United States labors in this respect. In these days of keen competition we cannot afford to suffer any handicap such as imposed by the conditions referred to, and the subject may well be referred to the thoughtful consideration of our own post office authorities.

NATURAL PRODUCTS AND RESOURCES OF THE PHILIPPINE ISLANDS.

BY M. W. HARRINGTON.

The great commercial products of the Philippine Archipelago are sugar, hemp, tobacco, copra and coffee, and their importance, as articles of export, are in the order given.

The production of sugar has increased rapidly. In 1871, it was less than 100,000 tons; in 1881, 230,000 tons; in 1893, 261,686 tons; and it was then increasing at the rate of 15,000 tons per year. About one-third of the total production is from the province of Pampanga, in the central area of Luzon, and nearly north of Manila. The provinces about Manila Bay and the one north of Pampanga are also large producers. This sugar is exported from Manila and goes chiefly to Spain and Great Britain.

A better quality of sugar, but in smaller quantities, is obtained from the violet-colored cane in the central islands of Panay and Negros. The very best comes from the province of Capiz, on the north coast of Panay. This sugar is exported from Ilo-ilo, and is sent chiefly to the United States.

The processes of manufacture are yet crude and antiquated. There are a few large plantations, and these are generally monastic. These plantations are usually leased to Chinese half-breeds, from whom better results are obtained than from Europeans. The small cultivators perform their own work with hired labor, but suffer under the difficulty of not being able to manufacture economically. There is a tendency toward their absorption into larger estates, under the charge of corporations.

The Manila hemp is so called because of the resemblance of the fiber to that of hemp, at least in color. It is derived from the leaf stem of a banana plant (Musa textilis). The plant has an inedible fruit, and grows in poor soil. The best plants grow in southeastern Luzon and the adjacent islands of Samar, Leyte and Bohol. The plant is rudely cultivated, cut down when three years old, and the fibers separated from the surrounding tissue by rude domestic machines. It takes two natives to prepare 25 pounds a day.

The coarser outside fibers are exported in the crude state, chiefly to Great Britain, the United States and the Australian colonies, where they are used for making a highly prized cordage. The finer fibers are used at home for domestic manufactures of fabrics used for dress and ornament. They are light, transparent and very durable. The fabrics are varied by using some cotton, silk, or other fiber with the Manila hemp.

The native name for the fiber is abacá, taken from the plant. The abacá has been introduced into other parts of the world, but the conditions of its native home of the Philippines are more favorable and the labor is there so cheap that no successful competition has been established.

Export of abacá began in 1831, and the amount exported is steadily increasing. In 1893 it amounted to 97,787 tons, valued at ten million dollars.

Next in order of value, but first in popular estimation, is the so-called Manila tobacco. It is a highly prized tobacco, classed by some as the equal of Havana tobacco, and by a few as its superior. Certain it is that some Manila leaf is imported into Cuba, though it is not known how it is used. The Cuban tobacco is classified with regard to its excellence, the Manila with regard rather to its fine appearance. Manila tobacco is stronger than it looks, and it has a fine herby flavor, to which those who use it become very much attached.

The tobacco was made a monopoly of the government in 1781. That is, anyone could raise it, but the government only could buy it, and could set the price and pay for it when it pleased. It often pleased to be two or three years behind in its payments. In 1882 this restriction was removed, and small growers now can produce it more profitably.

It is grown over Luzon and the neighboring islands, but the very best comes from the two large provinces of Cagayan and Isabela, in the extreme northeastern part of the island. Here the land suitable for it is now all occupied. The cultivation of the plant requires little labor. The man of the household usually performs the tillage, and the women and children the rest of the work.

Rather less than half of the crop is sent out in the leaf and this goes largely to Spain and other European countries. The remainder is made up into cigars and cigarettes, two-thirds of which are consumed at home and the remainder exported, chiefly to the neighboring countries of continental Asia and to Japan. In 1893 about 11,000 tons of leaf were exported and nearly 140,000,000 of cigars. The price of this tobacco in the Oriental countries is low. Boxes of 500 excellent cheroots (a cigar open at both ends) can be got for $18.

The copra is a preparation of the cocoanut made in great quantities in tropical islands all over the world. It seems to be a relatively new product for the Philippines; 11,500 tons were exported in 1893. The cocoa palm is very common and highly prized in the Philippines. All parts of it are used.

Coffee was introduced in the Philippines, probably in the latter part of the eighteenth century, from Brazil. The first large plantation was established in 1826, and the production began to extend actively fifteen or twenty years ago. Latterly the export has decreased very greatly. It used to average 2,500 tons a year, but has recently sunk to only 300. This is probably due to the revolution, for the coffee is of good quality, some of it excellent.

Unlike Manila hemp and tobacco, the coffee requires some capital on the part of those who undertake it. It takes the trees four or five years to begin to bear. Those who are able to make the necessary advances have prospered greatly, and, especially about Manila, have become rich.

The exported coffees formerly went exclusively to France, but are now scattered well over Europe, usually through Singapore. They are of two sorts, the Manila and the Zamboanga. The first is grown about Manila, chiefly to the south and east of Manila Bay. It has a small berry and is more highly prized than the other. The Zamboanga coffee is produced in the south, principally on Mindanao and the Sulu Islands. The berry of this variety is larger, but less care is used in its preparation. It goes directly to Singapore.

Rice is the chief product of the Philippine Islands, but it is not exported. It is the staple food of the natives, and sometimes the supply is short. Both the mountain and lowland rice are produced, and more than ninety varieties are known. It is easy to cultivate them, and in favorable years the yield is very generous.

Maize is grown in considerable quantities. So are the sweet potato, yams, ground nuts, gourds, potatoes, peas. A little wheat is raised at high elevations. Among the fruits are the mango, plantain, banana, mangosteen, jack fruit, medlars, lanzon and durian, the last especially in the Sulu Islands. The islands are generally mountainous, and at proper elevations the fruits of southern Europe and of Florida flourish, as the orange, citron and sapotilla.

The cotton of this archipelago is excellent and its production makes some progress. The cacao can be successfully grown and of good quality, but little attention is paid to it. The tea plant has been tried in botanic gardens and is found to thrive. The islands are rich in odorous flowers, and the manufacture of essences and perfumes is increasing. Cinnamon, the pepper tree and many other of the valuable plants of the Malay Peninsula and the East Indies either grow here naturally or can be easily introduced.

The islands are very rich in forests and they contain many valuable woods, mostly unknown even by name in the rest of the world. There are said to be thirty-two tinctorial woods, giving the entire series of colors and shades. Among the valuable ones is the ebony, with very black and fine-grained wood, of high value for fine furniture. The magkano of the forests of Mindanao is said to be absolutely indestructible by rot. The forests generally remain intact in the interior except for Luzon, where they have been extensively thinned out or cleared off.

The chief domestic animal is that useful and tractable Oriental beast, the buffalo, not our bison, but the buffalo proper. He is especially useful in the simple and rude tillage still used by the natives. The horse is small, active, hardy, but rustic. He is derived by a mixture of Oriental and Occidental stocks. The ox, goat and hog do well, but the sheep are inferior. The most of these animals have in places escaped from domestication, and large numbers of wild ones may be found, usually in herds.

The native manufacturers of the Philippines are not few, and their textile fabrics are especially fine and worthy of a larger market than they have so far found. The natives make many other things, among them a coarse pottery of great utility.

Valuable minerals are generally diffused through the islands, but few are yet mined profitably. Gold exists generally over the entire area, in placers and veins, but usually in quantities which do not pay with the rude methods employed for its collection. It is mined in the Camarines Norte province in southeastern Luzon and in the Misamis and Surigao placers of northern and northeastern Mindanao, but with small results. With the refined modern methods of collecting gold it could be profitably obtained in many places, and probably the prospecting has been incompletely done.

There are two known coal fields, one in southern Luzon, the other on the western slopes of Cebu and the eastern of Negros. The first probably extends over into Samar, and has furnished good steaming coal. One bed is known to be 10 to 20 feet thick. In the other there are at least five beds of varying thickness and quality.

Iron ore of excellent quality is known in southern Luzon, especially in the Camachin Mountains, where there are now a few small foundries. Copper ore has long been known in the province of Lepanto. It was early worked by the natives, and in 1862 a company was formed to conduct copper mining in this region. It is also found on Masbati Island, on Panay, and in several other places. Traces of lead and mercury are known, and also of rock oil. Sulphur is obtained on Leyte for use in the powder factory at Manila. It comes from a solfatara at Mount Manacagan.

FOOTGEAR FOR THE SOLDIER.

The greatest English soldier and commander of modern times said that the most essential thing for a soldier is a good pair of boots, and the second most essential thing is a second pair of boots. Every one who has had any experience with marching troops will be likely to agree with this immortal. Now that 125,000 of our National Guardsmen, from all walks and stations of life, have been mustered into the regular service, it behooves the commissary department of the army and its various agencies to use supreme vigilance, precaution and wisdom in providing suitable footwear for this vast number of practically raw recruits.

It probably does not overshoot the mark to say that eighty per cent of the men who have enlisted are improperly shod on entering service. And if the commissary department is not in possession of properly accredited and well advised purchasing agents, these soldiers are likely to be seriously handicapped and many of them made useless as implements of war when they come to be landed in Cuba or the Philippines, where they will be subjected to tests of unaccustomed climate and soil. The quartermasters of companies should therefore bear in mind in attending to the shoeing of their troops that they are not dealing with the normal foot in the vast majority of cases. This is the first obstacle to contend with. The second is the vanity of man concerning his feet, even though he be a soldier.

The absolute requisites in a shoe for marching are that it be comfortable and enduring; that is, that it be made on the right kind of a last from the proper material, and that it be properly and firmly put together. The essential elements of the first are that it have a straight inside line; that the sole lie flat or nearly flat upon the ground; that the arch be firmly and solidly supported; that the shoe fit snugly around the heel and the instep; and finally, in order that the pressure may be equally distributed, that there be sufficient room for the unhampered play of each pedal articulation when the weight of the body is successively thrown upon it. Unless the shoe fulfills these indications, it should be discarded. The sole should project beyond the upper so as to give firm support to the foot when it is fully expanded under the combined influence of the weight of the body and the resultant muscular relaxation of fatigue; and it should be composed of solid double sole, not paper or leather packing sandwiched between two thin pieces of leather, which, unfortunately, is often found. The uppers should be of stout, yet pliable, thoroughly seasoned hide, double stitched and by proper dressing made impervious to moisture. If these details are insisted upon, more will be done toward contributing to the capacity of the soldier than by the most elaborate system of acclimatization. It is more necessary to make Mulvaney immune to fatigue than it is to make him immune to fevers; by accomplishing the former you encompass the latter.

A properly clad, well fed American soldier is well prepared to give battle to the Cuban germ and the Spanish parasite, but he expects his government and its officers to provide him with the most approved implements of war and accouterment. It is the poorest sort of economy to grudge a few cents on a pair of shoes, especially in the light of what has just been said. Yet this is what the quartermaster's department has set out to do, if we may give credence to the reports in the daily press. In response to an invitation for estimates for 25,000 pairs of shoes, Chicago manufacturers offered to furnish army footgear at prices varying from 90 cents to $2 per pair. It is not at all improbable that the latter figure embraces the cost of manufacture plus a fair profit for shoes that will meet all the requirements mentioned above, while it is just as certain that any figure very much below it does not do so. This is not the time to be cent wise and dollar foolish. A few cents extra expended on a pair of boots may mean a live, fighting soldier in time of pressure and of need, while a 90-cent pair will be very sure to be found bound in tatters on a lamed or dying sacrifice.—Medical News.

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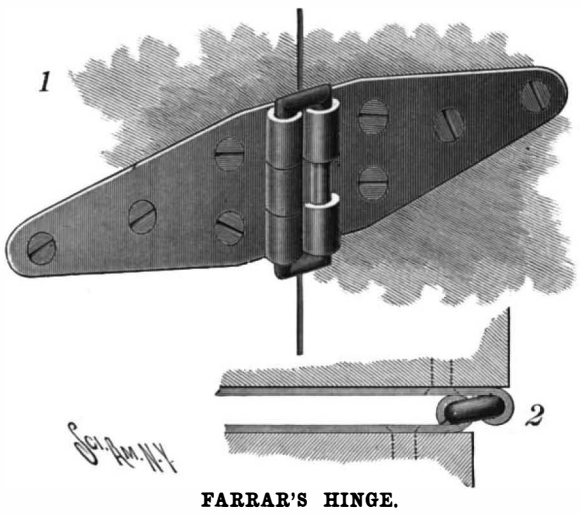
A NOVEL HINGE.

Of the accompanying illustrations, Fig. 1 represents a perspective view and Fig. 2 a broken plan view of a recently patented improvement in strap or butt hinges which embodies an advantage in the direction of strength while preserving simplicity of construction without appreciably increasing the cost. By this invention each strap or butt has a plurality of knuckles, a double pin being employed, each leg of which has its complement of aligning knuckles. The cut shows a strap hinge embodying the improvement. One strap



FARRAR'S HINGE.

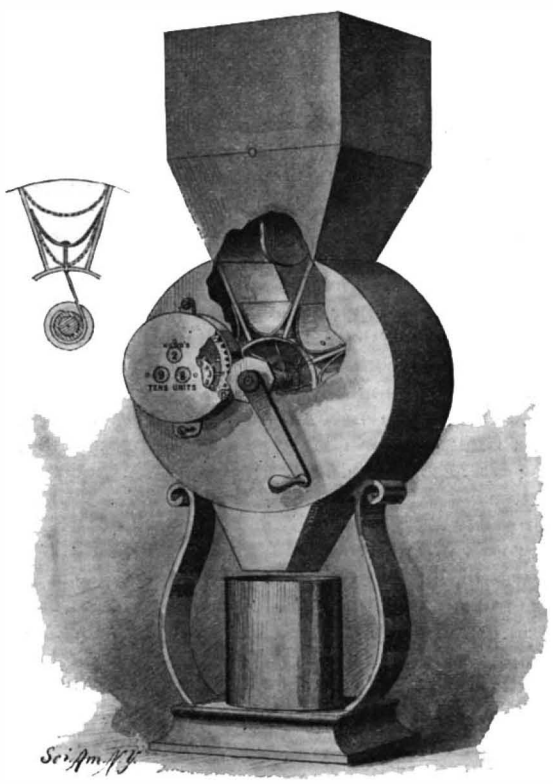
is provided with three knuckles, the middle one extending beyond the other two. The companion strap has an upper and a lower knuckle, which, when the parts of the hinge are assembled, receive between them and align with the central projecting knuckle of the other strap. The legs of a double or link-pintle pass through the registering knuckles of both straps or butts. With this construction each strap has virtually an independent pintle and a plurality of knuckles; yet both straps are so connected by the same pintle that they will work freely. By thus distributing the strain at the knuckles, it is claimed, greater strength will result without increasing the bulk or cost. The center of the hinge shifts around when the door swings, and by making the knuckles perfectly round, the straps can fold back closely together.

The invention has been patented by John J. Farrar, of Rapid City, South Dakota.

A NOVEL WEIGHING AND DELIVERING MACHINE.

An ingenious weighing machine, designed to weigh and deliver accurately and automatically powdered, granular or similar material, such as flour, sugar, coffee and the like, and, at the same time, to register the amount thus weighed, has been devised and patented by Prof. Shanker Abaji Bhise, F.S.Sc., President of the Bombay Scientific Club, of 2 and 4 Cathedral Street, Ramwadi Market Post, Bombay, India.

The machine, as shown in our illustration, comprises



BHISE'S IMPROVED WEIGHING AND DELIVERING MACHINE.

a suitably supported cylindrical casing having a feed hopper adapted to receive the material to be weighed. The measurer is carried in the casing and consists of a series of radially arranged receivers mounted on a suitably driven horizontal shaft. While the material is pouring into the uppermost receiver, the lowermost receiver is discharging. Means are provided whereby differences of weight per cubic inch are compensated for. This is accomplished by providing each compartment with a false elastic bottom bent so as to enable it to be introduced in the receiver, which bottom, owing to its resilience, normally tends to rise and expand at its ends to reduce the size of the receiver. Each elastic bottom has a flexible strand or chain secured to its center and extending to a rotatably adjustable sleeve on the shaft. A rotatable movement of the sleeve thus adjusts the positions of all the bottoms simultaneously.

A registering mechanism is provided, whereby the amount of material weighed may be quickly ascertained. A pinion on the shaft of the measuring cylinder meshes with a main spur gear, and a series of registering wheels are provided with spaced radial projections which are engaged by a series of changeable, spaced, radial pins projectable from the spur gear. The frequency of the impulses given to the unit wheel, and by it to the other registering wheels, may be increased or diminished by increasing or diminishing the number of projecting pins.

Prof. Bhise informs us that he invented the machine in response to a call in The Inventor's Review and Scientific Record, London, and in competition with several inventors won the prize which was offered.

Railroad Mileage of Europe.

At the beginning of the year 1897, there were, in all Europe, 159,025 miles of railroads in operation, this being an increase during the year 1896 of 3,144 miles, says Consul Du Bois, of St. Gall. Of this increase, Austria-Hungary had 806 miles, of which Hungary had 579 miles. In Russia, there was an increase of 555 miles. This, of course, does not include the great transsiberian and transcaucasian lines, with their 2,883 miles, a large portion of which has recently been opened to traffic. Germany increased her railroad mileage 579 miles—the same as Hungary—the kingdom of Prussia receiving 387 miles.

The countries of Europe now having the most railroads in operation, according to their areas, are, in their order: Belgium, 3,582 miles; Great Britain and Ireland, 21,217 miles; Germany, 29,355 miles; Switzerland, 2,209 miles; Holland, 1,608 miles; France, 25,089 miles. The other countries of Europe have the following railroad mileages: Austria, 18,951; Denmark, 1,605; Spain, 7,615; Greece, 590; Italy, 9,349; Luxemburg, 269; Portugal, 1,451; Roumania, 1,784; Russia proper, 22,455; Finland, 1,484; Servia, 335; Sweden, 6,073; Norway, 1,201; Turkey and Bulgaria, 1,507; the islands of Jersey, Malta and Man, 68 miles.

THE "OLIVE" BICYCLE.

We present herewith sectional views of the crank hanger arrangement and seat-post adjusting devices which, in conjunction with other features, are distinguishing characteristics of the "Olive" wheel, manufactured by the Olive Wheel Co., of Syracuse, N. Y.

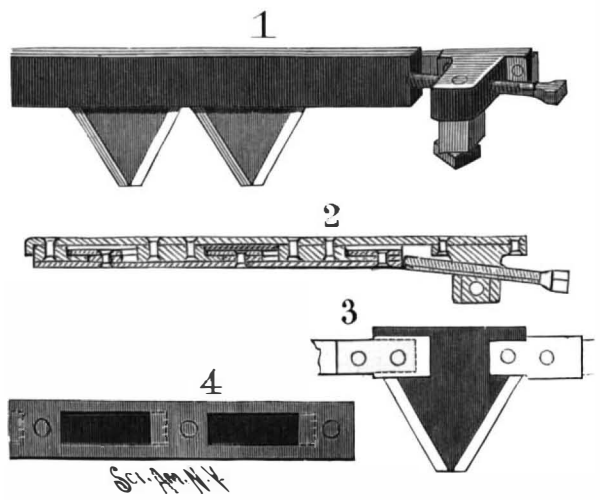
Referring to our illustration, it will be seen that the V-shaped end of a boss formed integrally with the sprocket-wheel fits into a similarly shaped recess in the axle, on the opposite end of which is integrally formed one of the pedal cranks. The other pedal crank is placed against the outer face of the sprocket wheel. A threaded bolt passes through this separately formed pedal crank into the sprocket wheel and its boss, and enters the axle at its recessed end. A collar fitting over the boss inwardly from its V-shaped end forms the cone bearing at the sprocket-wheel side of the hanger. The other cone bearing is formed by a threaded sleeve on the opposite end of the axle. The simplicity of this construction readily permits the various parts to be removed and cleaned, merely by unscrewing the connecting bolt.

Turning now to our other illustrations, it is seen that the saddle-post telescopes into the usual seat-mast and is provided at its front portion with orifices. The triangular space left between the post and the top tube receives a wedge-shaped block having projections adapted to fit into the orifices of the post. When it is desired to alter the position of the saddle, the post and its block are raised and the block made to engage the desired orifices to give the required adjustment; the post is then lowered until the block meets the frame. A transverse fastening device engages the block and frame and prevents the accidental displacement of the several parts. By this simple adjustment, the use of nuts, screws, bolts and wrenches is dispensed with so far as this portion of the bicycle is concerned.

THE University of Paris has been authorized to borrow $340,000 for the construction on the Rue Cuvier of buildings and laboratories for instruction in the sciences preparatory to the study of medicine, and for the completion of the laboratory of physiological botany at Fontainebleau.

AN IMPROVED CUTTER BAR.

The illustrations which we present herewith represent an improvement in cutter bars recently patented by Charles E. Frye, of Wilton, New Hampshire. Mr. Frye's cutter bar is so constructed that each blade will be contained in an independent pocket, means being provided by which a single cap will lock all the blades in position. Of our illustrations, Fig. 1 is a perspective view showing a short portion of the cutter bar, Fig. 2 presents a longitudinal vertical section, Fig. 3 a partial plan view with the cap removed, and Fig. 4 a bottom plan view of the cap. The cutter bar is provided at intervals with blocks or projections, each wider at one end than at the other to form a projecting flange at the back and front edges. The under side of the wide end of the block is recessed to produce an overhanging lip which projects toward the inner end of the cutter bar. Blades formed with T shanks are so proportioned as to enable the shanks to enter the spaces between opposing blocks and to lie partly beneath the previously mentioned flanges and lip. A



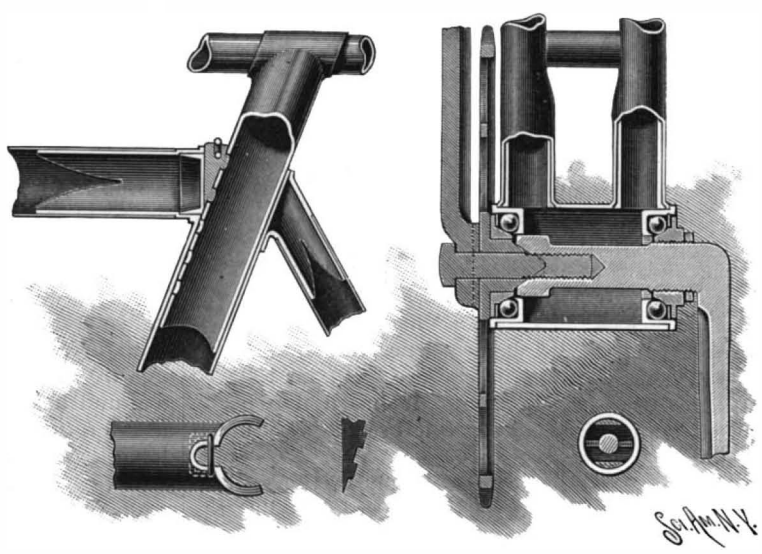
FRYE'S CUTTER BAR.

retaining cap is provided with depressions from which end recesses extend. The cap is thus made to fit over the blades, the depressions receiving the bodies of the blocks and the end recesses receiving the lips of the respective blocks.

In assembling the parts, one edge of a blade is entered beneath the lip of a block until the blade can seat itself on the bar. The extended portions of the T shanks prevent transverse movement. The retaining cap is now fitted over the blocks so as to cause each end recess to receive the lip of the corresponding block, and the set screw shown in our first two illustrations locks the cap tightly into place, preventing all independent movement of the parts.

Sensation of Hanging.

A captain who was rescued from the gibbet at the intercession of Viscount Turenne, after being partially hanged, related that, having lost all pain in an instant, by being rescued he had been snatched from a glorious light, the charm of which defied all description. All victims of partial hanging agree that the uneasiness is quite momentary; that a pleasant feeling succeeds, and that various colors start before the sight, casting everything else in oblivion. The mind, averted from reality, is engaged in scenes most remote from



THE "OLIVE" BICYCLE FRAME.

that which fills the eye of the spectator—the hideous gallows and the struggling form.

[The above from The Medical Council may be comforting to some one. An acquaintance related to the writer similar pleasant sensations he experienced when so near drowning he had lost all consciousness, and was, with great difficulty, resuscitated.—ED.]

DR. JULES MARCOU, the geologist, died on April 17, at the age of seventy-five years.

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Work of a Scientific Expedition in the Gallapagos Archipelago.

Dr. W. H. Harris, of Augusta, Maine, recently received an interesting letter from his brother Charles M. Harris, who is now at the head of the Rothschild expedition to the Gallapagos Archipelago after flora and fauna. Mr. Harris sailed from New York on March 20, for Panama, with a party of five. At Panama they expected to charter a schooner for the trip, but yellow fever was contracted, from which three of the party died. Mr. Harris proceeded to San Francisco, reorganized the party, and sailed on June 21 in the schooner Lila and Mattie, arriving at the islands after a forty-day passage. So far as is known, no such collection as he has gathered has been made since that of Darwin, in 1836.

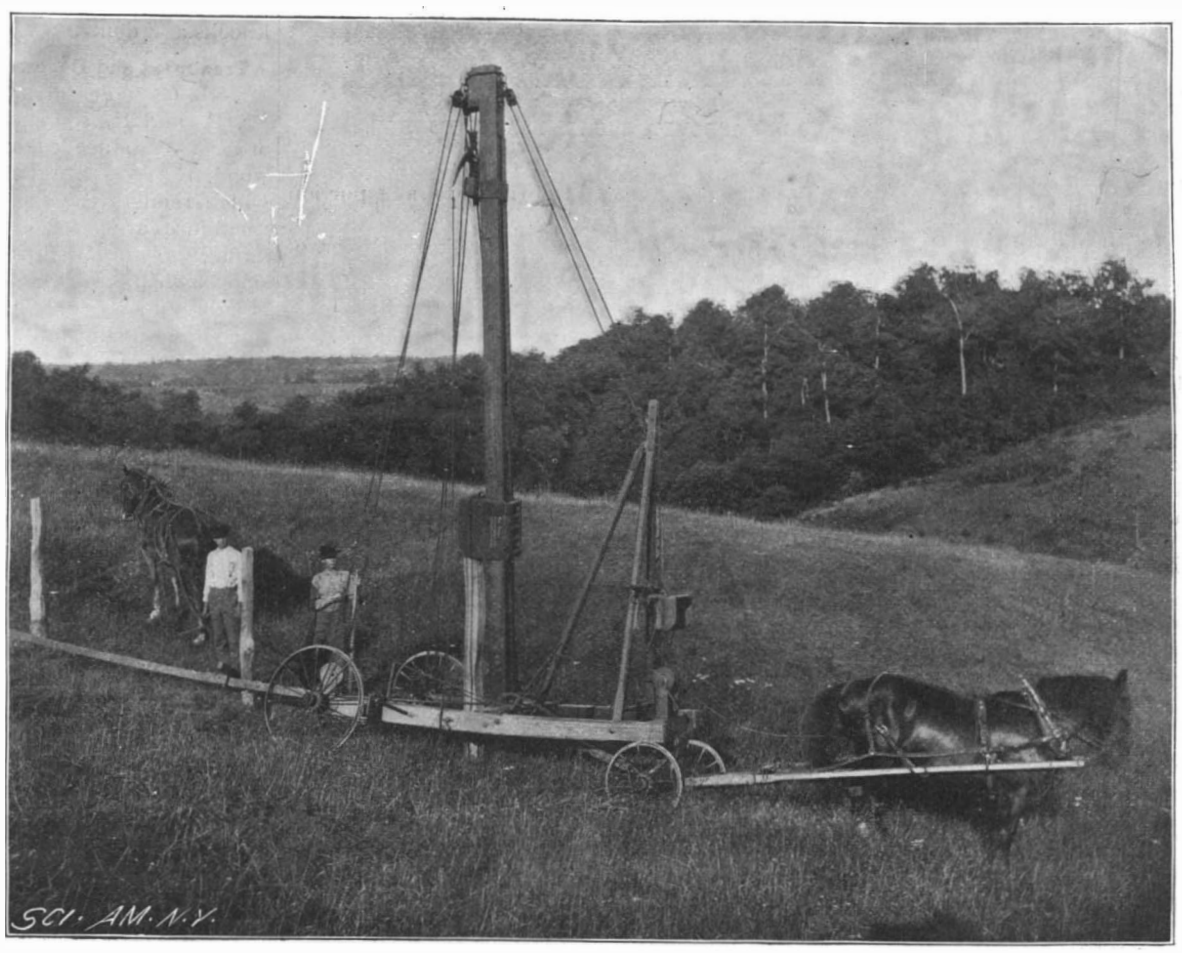
"As to our success, I think, barring accident, it is assured," says the letter. "We have now on board thirty live tortoises of two species, and two prepared skins. About two thousand birds have been saved so far. Besides the tortoises and birds, we have a large number of two species of iguanas, and numbers of lizards, snakes, birds' eggs, turtles, etc. We have covered about half our ground, having visited the following islands in the order named: Culpeper, Wenman, Abingdon, Bindloe, Indefatigable, Duncan, Jervis, James and Chatham. From here we will go to Hood, Charles, Brattle, Albemarle, Marlborough, Tower and Cocos, and then start for San Francisco, which we expect to reach about the middle of March next. We have so far succeeded in getting about all the species of birds recorded for the different islands visited, and undoubtedly some new ones.

"On James Island is an enormous volcano in a state of great activity. This is the first active volcano on the island since 1855. Twenty-nine of our tortoises were taken from Duncan Island, where it was supposed they were extinct. They were at the top of the island and in the bottom of an immense crater."

AN EFFICIENT FENCE POST DRIVER.

A fence post driver, simple in construction and effective in operation, has been patented by Lincoln H. Ketcham, of Corning, Ohio. In Mr. Ketcham's machine, of which we present a perspective view, a hinged mast is mounted upon a portable truck-frame and is adapted to be raised in a vertical position, or lowered to lie lengthwise of the truck. Drums and guy ropes are provided for raising and lowering the mast to the desired position, and a plumb bob located within a longitudinal groove in the mast enables the operator to adjust the position of the mast and to drive his posts vertically, notwithstanding the roughness or unevenness of the soil. A heavy hammer-block slides vertically on the mast and is operated by a pair of tongs carried by a bracket sliding above the hammer. A device at the upper ends of the tong members, consisting of a link pivoted to one of the members and striding the other, a pivoted wedge carried by the link, and a cord attached to the link, enables the operator to control the tongs, opening and closing them at pleasure, and causing them to grasp or release the lifting eye of the hammer.

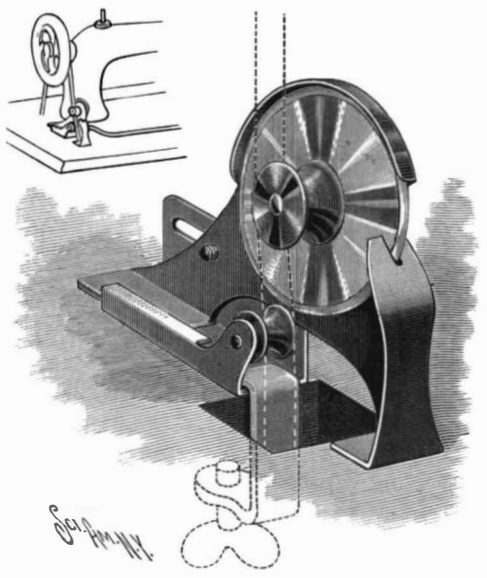
In operation the mast is elevated, the hoisting rope is attached to a horse, and the hammer lifted half way up the mast. In this position a transversely movable finger controlled by a pivoted operating lever is made to slide through an orifice in the rear face of the mast and located in the longitudinal groove, thus holding the hammer in a raised position. A pointed post is now put in place, and the finger withdrawn. The hammer glides down and starts the post in the ground. The hammer is now raised to its utmost height until the previously mentioned pivoted wedge touches the head block of the mast, thus acting on the tong members and releasing the hammer. By backing the horse the tongs are lowered until they again reach and engage the lifting eye on the hammer. The operation is repeated until the post has been driven to the required depth. The machine is now moved forward in the line in which the posts are to be driven until an adjustable bar or gage arm which extends rearwardly from the truck comes into contact with the last driven post. The distance between the posts is thus automatically regulated, and the machine is now in position for driving another post. With this machine posts up to eight feet in length may be rapidly and effectively driven.



POST DRIVER IN OPERATION.

A NOVEL RIPPING ATTACHMENT FOR SEWING MACHINES.

A ripping device of simple and practical form, to be used in connection with sewing machines, has been recently patented by Maurice Talen and George H. Croft, of Geneseo, Illinois. As shown by our engraving, the device is intended for attachment to the table of a sewing machine at the point where the belt passes upward through the table. The ripping is done by a rapidly rotating cutting disk driven by friction pulleys in connection with the driving belt of the machine. The cutting disk and its pulley revolve on a stud projecting from a vertical supporting plate which slides upon a base clamped to the table. At its upper edge the plate rounds over to form a guard-flange for the disk. To expose a section of the cutting disk, the plate is recessed at one edge, and a slitted guide flange at the recessed portion receives the disk and keeps the work in position. The base upon which the plate is mounted is provided with a shorter and a longer upwardly extending flange. The shorter flange is situated on the same side as the pulley of the cutting disk and in it a roller is journaled coacting with the pulley of the cutting disk. The longer flange is horizontally slotted to receive a set screw which works into the disk-carrying plate, holding the latter in adjusted position. In using the device, the clamping bracket is made fast to the table, with the belt running between the two pulleys, as indicated by dotted lines in the cut. The relative angular position of the two pulleys may be varied by shifting the disk-plate along its base and fastening it in the desired position by the set screw. By this means a larger or smaller arc of contact is obtained, thus increasing the tension of the belt. The ripping is rapidly effected by presenting the seam to the sharpened edge of the rotating disk. The device forms a desirable addition to the auxiliary adjuncts of a sewing machine.



TALEN & CROFT'S RIPPING ATTACHMENT FOR SEWING MACHINES.

Are Canned Goods Fit to Use?

The so-called canning industry has made such vast strides all over the world, and notably in America, that it is not surprising that this method of preserving foods should form the subject of inquiry at the hands of the bacteriologist. When we learn that in Baltimore alone 1,250,000 bushels of oysters are annually canned and that the United States is responsible for 120,000,000 cans of tomatoes, and of other articles, such as fish of various kinds, and fruits, etc., in similarly large numbers, it is remarkable that Messrs. Prescott's and Underwood's paper, "Micro-organisms and sterilizing processes in the canning industry," published in The Technology Quarterly, should be the first contribution to so important a subject. These gentlemen have specially studied the bacterial flora of canned clams and lobsters, which have broken down, or, in other words, been imperfectly preserved. In every case where "spoiling" had occurred, bacteria were present in large numbers, while in no instance were any discovered in sound cans. Sometimes only a single variety, or a pure culture of a particular microbe, was found in unsound cans, but usually the latter contained a mixture of several species. Nine different bacteria were selected and isolated for subsequent study, both as regards their macroscopic and microscopic appearances; two of these were cocci, the remainder bacilli forms. These bacteria were afterward inoculated into the contents of sound cans, with the result that the latter invariably decomposed, while experiments were also made to test the method of applying heat to canned articles which would most effectually destroy the chances of these micro-organisms surviving and spoiling the contents. An account of the numerous experiments carried out by the authors on this highly important commercial side of the inquiry will be published later; meanwhile their investigations go to show that, given a proper control of the temperature, it is possible to preserve clams and lobsters with absolute certainty, and in a more perfect condition than has hitherto been possible.

Thirty Miles for an Acorn.

Down in Mexico there lives a woodpecker who stores his nuts and acorns in the hollow stalks of the yuccas and magueys. These hollow stalks are separated by joints into several cavities, and the sagacious bird has somehow found this out, and bores a hole at the upper end of each joint, and another at the lower, through which to extract the acorns when wanted. Then it fills up the stalks solidly and leaves its stores there until needed, safe from the depredations of any other thievish bird or four-footed animal.

The first place in which this curious habit was observed was on a hill in the midst of a desert. The hill was covered with yuccas and magueys, but the nearest oak trees were thirty miles away, and so, it was calculated, these industrious birds had to make a flight of sixty miles for each acorn stowed thus in the stalks!

An observer of birds remarks: "There are several strange features to be noticed in these facts: the provident instinct which prompts this bird to lay by stores of provisions for the winter, the great distance traversed to collect a kind of food so unusual for its race, and its seeking in a place so remote from its natural abode a storehouse so remarkable."

Can instinct alone teach, or have experience and reason taught these birds that, far better than the bark of trees or crevices in rocks or any other hiding place are these hidden cavities they make for themselves with the hollow stems of distant plants?

This we cannot answer. But we do know that one of the most remarkable birds in our country is this California woodpecker, and that he is well entitled to his Mexican name of el carpintero—the carpenter bird.—St. Nicholas.

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Science Notes.

A French ironclad launched a few days ago was christened the Lavoisier.

Lake Huron divers have accomplished the feat of recovering a cargo of 600 tons of copper from a wreck submerged to a depth of 160 feet, where it had been for thirty-two years.

Cambridge University has sent out an expedition to Torres Straits, between New Guinea and Australia, to study the anthropology of the natives. Seven professors are in the party: two will study native psychology; one, who carries a phonograph, their music; another their decorative art. They have a cinematograph to record native dances and ceremonies. The expedition may provide a valuable contribution to native gastronomy.

M. L. Decombe, of the Paris Academy of Sciences, now enjoys the record for rapid photography, having bern successful in photographing the period of the Hertzian oscillation, which occupied less than the five-millionth of a second. A rapidly rotating mirror was employed, and the explosive spark reflected from it through a collimating lens of very short focus, so as to present the spark in the focal plane of the lens. Previous to this Prof. Boys' photographs of bullets in their flight was the best achievement in the photography of rapidly moving objects.

Dr. Marpmann, of Leipzig, has recently published the results of the microscopical examination of sixty-seven samples of ink used in schools. Most of them were gall inks, and contained saprophytes, bacteria and micrococci. Nigrosin ink, taken from a freshly opened bottle, was found to contain both saprophytes and bacteria. Red and blue inks also yielded numerous bacteria. In two instances Dr. Marpmann succeeded in cultivating from nigrosin ink a bacillus which proved fatal to mice within four days. The presence of these pathogenic organisms in ink accounts for the nasty sores which sometimes result from the scratch of a pen.

Science announces that Prof. W. A. Rogers died at Waterville, Maine, on March 1, aged sixty-one years. He was assistant professor of astronomy in the observatory of Harvard University from 1875 until 1886, when he accepted a call to the professorship of physics and astronomy at Colby University. He had expected to enter on a professorship at Alfred University, N. Y., on April 1. Prof. Rogers was a member of the United States National Academy and a past vice-president of the American Association for the Advancement of Science. He made important contributions to astronomy and physics, especially to the technique of measurement.

An argillaceous earth named "tfol," which contains free gelatinous silica, is largely used in Northern Africa by the Arabs as a substitute for soap in washing linen. Lahache finds that it has great capabilities of absorbing oil, one part of this substance completely absorbing five parts of heavy tar oil. When the compound is mixed with water a perfect emulsion is formed, which does not adhere to the sides of the vessel. It is proposed to employ this earth for the purpose of emulsifying heavy tar oil for disinfecting purposes. For this purpose the "tfol" is first mixed with an equal weight of water and then intimately incorporated with sufficient heavy tar oil to make a paste.—Journ. de Pharm.

Dr. Charles Wardell Stiles, of the United States Department of Agriculture, has been appointed attaché to the United States Embassy in Berlin, says Science. Dr. Stiles' duty will be to keep the Agricultural Department informed on important discoveries and other matters of interest to agricultural science, to defend American meats, fruits and other exports against unjust discrimination, and to advise the Secretary of Agriculture from time to time concerning the purity of the food products that are shipped from Germany to the United States. It is said that the appointment of Dr. Stiles will probably be followed by other similar appointments, and it consequently represents an important advance in the application of scientific principles to diplomatic and commercial affairs.

The Meteorologische Zeitschrift, a German scientific publication, contains a treatise by Dr. F. Maurer on the regular periodical repetition of cold and warm years. During certain intervals of time, extending as a rule to about fifteen years, there is a recognized change of warm and cold periods. The warm periods, he says, do not simply include a series of summers of extraordinary warmth, but also a series of mild winters. Similarly, during the cycle of a cold period, not only are the winters more than ordinarily severe, but the summers are far below the average heat. Dr. Maurer affirms that we can predict with tolerable accuracy the time when the next cycle of warm periods will occur. It is due, he calculates, somewhere about the turning point between the two centuries; and he thinks it probable, from the data obtainable, that the early years of the next century will be distinguished by a series of hot, or rather extremely hot, summers and a series of exceptionally mild winters.

The Metric System Legalized in Great Britain.

In its issue of December 25, 1897, The London Times says a report by the Board of Trade on their proceedings and business under the weights and measures acts, 1878 and 1889, has just been issued as a parliamentary paper, in which it is stated that, during the past session, an act (60 and 61 Victoria, chapter 46) has been passed to legalize the use in trade of weights and measures of the metric system. A table of new equivalents of metric weights and measures, in terms of the imperial weights and measures, is given in the report. This table of equivalents is based on comparisons made by the Comité International des Poids et Measures, Paris, and the Standards Department, which have been completed during the year.

SUGAR PLANTER'S HOE.

A sugar planter's hoe, designed for use on hard ground to clean out cane furrows, is presented in the accompanying engraving. The hoe comprises a blade of increasing width from top toward the bottom, the side edges from the rear to a point terminating at a distance short of the front edge presenting a series of elongated teeth. The blade in front of the teeth is plain and untoothed, the untoothed side portions being approximately in line with the teeth. In the center toward the upper edge is an orifice surrounded by a flange or neck in which a handle may be inserted. After cutting the weeds, they are raked together or between the rows,

AN IMPROVED SUGAR PLANTER'S HOE.

a turn of the wrist sufficing to bring the rake portion into position.

The hoe has been designed by Frank H. Foster, of Wahiawa, Koloa, Kawai, Hawaiian Islands.

The Mosquito—A Nuisance Easily Abated.

The summer months will soon be upon us, and it behooves us to equip ourselves in a manner to meet the discomforts of the season with patience and grace, and in so far as we can escape them.

One of the most annoying features of the latter months of the summer, along the banks of rivers and on the sea coast, is the mosquito, and anything helping us to abate the nuisance is important. Apropos to the subject, says The Monthly Retrospect, a recent number of The Public Health Journal observes:

"Two and one-half hours are required for a mosquito to develop from its first stage, a speck resembling cholera bacteria, to its active and venomous maturity. The insect in all its phases may be instantly killed by contact with minute quantities of permanganate of potash. It is claimed that one part of this substance in 1,500 of solution distributed in mosquito marshes will render the development of larvæ impossible; that a handful of permanganate will oxidize a ten-acre swamp, kill its embryo insects and keep it free from organic matter for thirty days at a cost of 25 cents; that with care a whole State may be kept free of insect pests at a small cost. An efficacious method is to scatter a few crystals widely apart. A single pinch of permanganate has killed all the germs in a thousand-gallon tank."

The belief has been generally held that the filling in of the meadows with the ashes from near-by cities would prevent the development of these pests, and the providing of a place for the ashes would be another good. It is doubtless true that the potash which would leach from ashes will—like a solution of the permanganate of potash—render the development of insect life impossible.

Miscellaneous Notes and Receipts.

Weighting Silk.—For the weighting of silk Renard recommends the following process in L'Industrie Textile: Pass through a chloride of zinc solution and wash. Then pass in the cold or warm through a solution of phosphates, silicates or tungstates of the alkalies, and finally, after another washing, in cold or warm solutions of such metallic salts as form insoluble phosphates, silicates or tungstates.

To Produce Stuccoed Flowers from Plaster of Paris.—Take natural flowers and coat the lower side of their petals and stamens with paraffine or with a mixture of glue, gypsum and lime, which is applied lightly. Very fine parts of the flower, such as stamens, etc., may be previously supported by special attachments of textures, wire, etc. After the drying of the coating, the whole is covered with shellac solution or with a mixture of glue, gypsum, lime with lead acetate, oil, mucilage, glycerine, colophony, etc. If desired, the surface may now be painted with bronzes in various shades. Such flowers are now much employed in the form of festoons for decorating walls, ceilings, lusters, etc., and are very handsome.—Der Dekorationsmaler.

Bleaching Shellac.—Dissolve 1 part of shellac in 2 parts of absolute alcohol and let stand a few days in a warm place. Then prepare a mixture of 1 part of chloride of lime (20 per cent) in 3 parts of water, filter through linen and wash the residuum with ½ part of water. The filtered and the wash water are united and mixed with an aqueous potash solution (33 per cent) until no more precipitate falls down. The filtrate of this process is stirred into the warm solution of shellac, and after half an hour sufficient hydrochloric acid is added to produce a decided acid reaction, whereupon the shellac settles as a perfectly white mass. Same is taken out, washed in boiling water until this no longer runs off milky, and dried in the air. The alcohol can also be recovered from the solution.—Färben Zeitung.

Coating for Metallic Reservoirs.—According to the Ges. Kohl. Ind., a French process consists in mixing intimately barium sulphate with albumen and using the paste received for painting the metallic surfaces to be protected. The tank must first be cleaned with a soda lye, then it is painted with a priming coat, which is dried by the application of heat until hard. Then the reservoir is furnished with a second coating, which is also dried; the coat is exposed to the action of steam or boiling water, which causes the white of egg to coagulate. Finally, the whole is once more moistened with albumen, and steam or boiling water is used again. This paint is extremely resisting and durable against mechanical as well as chemical agents. It adheres so firmly that it can only be scratched off by means of sharp instruments. Finally, this coating does not crack or scale off, even if the reservoir receives knocks and dents.

Treatment and Decoration of Furniture, Woodenware, etc.—L. G. Andes gives, in the Zeitschrift für Drechsler, E. and H., some directions on this subject. In order to produce colored decorations on wood, the wooden plates are treated with hydrochloric acid, which renders the surface of the wood porous. Now the figures are pressed in with an engraved plate and strong pressure, and the whole plate is polished off smooth with pumice stone. When the wooden surface is subsequently coated with a color solution, a handsome design will result, because the pressed and denser places take up less color, thus showing a lighter tone of the same color than the places not pressed.

For preserving varnished and stained woodenware, the following process is recommended: The lye, prepared from 3 parts potash, 1 part calcined tartar and 24 parts water, and thinned with 48 parts water, is spread out uniformly, to prevent the formation of spots. After three to four minutes' action, the lye will have dissolved the dirt, and rinsing off with water should follow. It is also advisable to clean varnished articles with olive oil. Flour, hair powder or prepared white hartshorn is dusted on the applied olive oil, and the olive oil is rubbed off again with a soft rag. By this means not only the dust and spots are removed, but the gloss of the furniture is restored at the same time.

The following process is well adapted for the production of black, faintly lustrous polished surfaces: Plane the surface smooth and clean it nicely, stain with a strong decoction of logwood chips, and after this coating is half dry, finish staining with iron liquor (iron pyrolignite); allow the resulting black coloring to dry well and rub down the raised grain carefully. If light places appear in consequence of the rubbing, stain them black again. After the last rubbing with pumice stone and oil, polish the surface with pale shellac polish in which some aniline black has been dissolved, or dissolve the aniline black in the alcohol necessary for rubbing down, and finish coloring in this manner. When the polished surface has become dry, rub it down with burnt pumice stone and water, using a piece of hat felt, remove the mass entirely, and give the surface a dull luster by treatment with wax salve.—Dingler's Journal.

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NEW SYSTEM OF ELECTRIC SIGNS AND SIGNALS.

Our front page is devoted to the illustration of a new system of signs and signals, whose operation is secured by the ingenious combination of a set of incandescent lamps and typewriter keyboards. This somewhat elaborate plant is a development on a large scale of a recent invention of L. S. Crandall, whose name is well known in connection with his work in the development of the typewriter. The object of the device is to enable electric signals to be spelled out, as it were, upon a large board or frame suitably displayed in some conspicuous position, the letters being successively flashed out in lines of light which are visible at a distance of several miles.

The fundamental feature is a large shallow box or frame, Fig. 3, in which a number of incandescent lamps are arranged in certain lines and curves, which are so related as to enable any letter of the alphabet to be formed by them. The lamps are electrically connected in clearly defined groups, as shown in Fig. 8. There are nineteen groups in all, and each group has its own separate electrical connection with the main line and with the return current. By this arrangement it is possible to excite any one or any combination of the nineteen groups, the rest remaining dead, and thereby cause the desired letter of the alphabet to shine out in the frame.

It will be seen that the pattern is made up of two bisecting crosses, bounded by a vertical line on each side of the frame, and two curved lines, one at the top and one at the bottom. By comparing the wiring diagrams, Figs. 7 and 8, it is easy to understand how the letters are formed. In Fig. 7 the letter M is shown in small white spots representing the lamps that are lit. These lamps, it will be seen, include groups 1, 2, 3, 4, 5, 6, 7, 8, 15, 16, and 17. If the letter T were to be shown, it would be necessary to excite groups 2, 3, 9, 13, 14, and 15. The letter O again would require the combination 5, 6, 7, 8, 9, and 10.

As a counterpart to this "monogram," as it is called, a keyboard is provided by means of which, on pressing any particular button, the current is switched onto the groups of lamps which form the desired letter. With this keyboard in front of him the operator is able to spell the desired word, letter by letter, in brilliant lines of light upon the monogram board, which is displayed in some prominent position.

This is the system which was satisfactorily tested by the government on the night of April 2, in New York Bay. The frame, measuring 3 feet in width by 5 feet in height, was erected on the top of a hotel fronting on the bay, and the government boat withdrew to a distance of a mile. Here it was possible to read the messages with the naked eye. The letters were easily distinguished with glasses at the three and a half mile mark. On this occasion the "ray protectors," to which reference is made below, were not used, and it is therefore considered probable that with these in place the messages will be decipherable at a distance of five or six miles in clear weather.

Instead of using only one frame, and producing the words letter by letter, it is of course possible to combine any number of frames and give the message, advertisement, or what not, in full. This has been done by a well known New York paper in the elaborate plant which we illustrate on our first page. Upon the roof of one of the buildings which front on Madison Square, a double bank of 38 frames has been erected. The frames are all identical with the one shown in Fig. 3, and each frame is connected directly to its own keyboard. The construction of the keyboard is as follows: There are 26 key bars, corresponding to the letters of the alphabet, and the buttons are arranged on the system adopted on the Remington typewriter. Beneath the keybars are nineteen contact bars, corresponding to the 19 groups in the frame, which run transversely across the board. The bars are connected through terminal posts to the nineteen groups of lights in the frame. Each keyboard carries a number of contact pins, Fig. 6, which, when the bar is pressed down, throw into circuit the proper groups to form the desired letter. The arrangement is clearly shown in Figs. 1, 2, 5 and 7. It should be mentioned that, when a single box is in use, all of the 26 keybars are in the main line circuit and that, normally, the bars are kept out of contact with the contact bars by the spring shown at the hinge end of the keybar in Fig. 5. Consequently, the lamps in the frames are dead, except when they are thrown into circuit by the depression of the keys.

In the large installation at Madison Square there are thirty-eight frames arranged in two tiers. Each frame consists of a shallow metal box about 8 inches deep, 3 feet wide and 5 feet high. In order to prevent the flood of light from producing a blurred or confused effect, it has been found necessary to confine each light in a "ray protector," which in this case is simply a tin funnel (Fig. 4). This prevents the lights from blending, as it were, and sharpens the effect as seen from a distance. Another form of "protector" is shown in Fig. 9, in which the light is confined in channels. This form is simple in construction and made of sheet metal. Another method adopted is to cover the frame with a sheet of black glass, with clear lines left in front of each group of lights.

The illustration, Fig. 10, shows the interior of the switchboard room, which is erected on the roof of the building near the monogram frames. On three sides of the room are arranged the thirty-eight keyboards corresponding to the thirty-eight frames. In making up a sign or an announcement the operator presses the desired button on each keyboard, the key being held down by a magnet which extends across the board as shown in Fig. 1. When all the keyboards have been arranged, the main current is turned on at the switchboard, and the whole thirty-eight boxes are illuminated.

It is considered that the system will prove of considerable value in naval, military and coast defense work. For such operations it has the important features of distinctness and reliability. There is practically no limit to the size of the letters, which might be made 10 or 15 feet high if desired.

The Value of Fruits.

Fruits are of great value in many forms of disease, says Modern Medicine, because of the acids which they contain. These acids, when taken into the blood, break up some of the compounds of waste substances which have been formed, and thus give rise to an increased excretion of these substances through the kidneys. In this way fruits are a great advantage in the treatment of rheumatism, gout, gravel and all the different morbid conditions which accompany the so-called uric acid diathesis. The observations of Haig respecting the relation of uric acid to neurasthenia give to fruit a great dietetic value in this disease. He has shown that neurasthenia is almost always the result of the accumulation within the system of tissue wastes largely in the form of uric acid. The free use of fruits aids in the elimination of these poisons, not only by breaking up the compounds which they form within the body, but by stimulating the kidneys to increased normal activity.

Remembering the interesting fact pointed out by Bouchard, that rheumatism is really a toxemia, resulting from the decomposition of food stuffs in a dilated or prolapsed stomach, we may also attribute the beneficial effects of a fruit diet in rheumatism and allied conditions to its value in suppressing the formation of poisonous substances in the alimentary canal in the manner already pointed out.

Obesity, which is, like rheumatism, a diathesis, may be successfully treated by a fruit dietary. This is due not only to the fact that fruit is a natural food, and thus aids the system to establish normal tissue metamorphosis and a normal balance between the processes of assimilation and disassimilation, but also because it affords a very comfortable means of reducing the amount of nutrient material received to a minimum quantity.

Fruit is chiefly water, the amount of nutrient material it contains varying from five to eight or ten per cent in most fruits, rising to a higher figure only in dried fruits, such as dried grapes, prunes, dates, etc. The writer has succeeded in reducing excessive weight in the most satisfactory manner, by prescribing a diet consisting almost exclusively of grapes or apples, allowing only a small bit of thoroughly dried bread or zwieback in connection with the fruit. In some cases the fruit may be allowed as often as three or four times a day, if necessary to relieve an uncomfortable sensation of emptiness.

In fevers, fruits, especially in the form of fruit juices, are a most convenient and certainly the most appropriate of all foods. It is now almost universally recognized that beef tea and meat preparations of all sorts should be wholly proscribed in cases of fever, as the patient is already suffering from the accumulation of waste matters to such a degree that the addition of even the small amount contained in beef tea or a small piece of meat may be sufficient to give rise to an exacerbation of the disease and lessen the patient's chances for recovery.

Uniforms of New York Troops in the Last Century.

In 1724, each trooper of the city of New York was obliged to provide himself with a horse at least fourteen hands high (fully armed and equipped); a good hat trimmed with silver lace; a black bag or ribbon for the hair or peruke; a scarlet coat trimmed with silver; a pair of boot with spurs; a carbine, etc.

A New York City trooper in 1740 had to provide himself with a good, serviceable horse, not less than fourteen hands high, covered with a good saddle, holsters, housing, breastplate and crupper; a case of good pistols; a good sword or hanger; half a pound of powder and twelve sizable bullets; a good hat trimmed with silver lace; a black bag or ribbon for the hair or peruke; a scarlet coat trimmed with silver; a pair of large boots with suitable spurs, and a carbine well fixed with a good belt, swivel and buckles. The Albany troopers were "cloathed in blew Coats with Hatts laced with Silver" (act of October 3, 1739).

In 1744, the trooper's hat was trimmed with gold lace, and the coat and breeches were blue, with gilt or brass buttons, while the waistcoat was scarlet.

In 1764, the New York City trooper wore a blue coat and breeches, with yellow metal buttons, scarlet waistcoat and hat trimmed with gold lace.

The uniform of the New York trooper in 1775 was a blue coat and breeches, with yellow metal buttons, scarlet waistcoat and hat trimmed with gold lace; that of the Albany trooper was a blue coat with white metal buttons, and a hat laced with silver; and that of the Kings County trooper was a blue coat and red jacket and a hat trimmed with silver lace (act of April 3, 1775).

English Comment on the War.

Commodore Dewey's dispatches do not add much to what was already known, or rather anticipated, about the Manila affair. From those and one or two private sources it appears that the Spaniards were lying at anchor, without steam up, many of the officers ashore, and the vessels apparently swung end on to the enemy. Anything more insane and disgraceful than the fashion in which the Spanish admiral allowed himself to be caught it is impossible to conceive. The only wonder is that the cry of treachery has not been raised in Spain. Those who raised it would certainly have apparent justification. The torpedo boats placed at the entrance ought, to a certainty, almost to have been able to account for at least one American warship. Inside again, off Cavité, had the Spanish had steam up as they ought to have had, it would have been quite feasible to get to close quarters with some of the American vessels defiling across their front. Had the crews and admirals changed places, the ultimate result could not have been different, but Americans in the "Isla de Cuba," "Reina Christina," and other ships would certainly have managed to foul some of the attacking fleet. Something might have been done with the ram, something with the torpedo; the wildest risk could not have been so foolish as electing to be sunk at anchor. It further appears that the Spanish fired shrapnel shell, since the American reports speak of shell bursting above and around them. Now the thin plates of a cruiser are sufficient to keep out shrapnel bullets, and the use of this projectile rendered the American ships equivalent to ironclads almost. The Spanish had better, like the Chinamen at the Yalu, have fired shells filled with coal dust, for then they would at least have stood a chance of making holes in the American cruisers. Probably they had no common shells, otherwise the results could hardly have been so absolutely one-sided, for very few 6-inch common shells would have been needed to make a very marked effect on cruisers crammed with guns. Admiral Dewey exhibited either sound judgment and knowledge of the enemy or else exceeding rashness; but that had nothing to do with the actual battle. That was practically target practice. If the Spaniards were end-on, they could only bring about half a dozen guns to bear upon the American ships. These last, making allowance for a certain proportion of quick-firers, carried at least fifty of superior caliber and with infinitely better gunners behind them. There were some forts, it is true; but it is questionable whether these contained anything better than a few 68-pounder muzzle-loaders or smooth-bores, unable to reach the enemy. The mine field we should accept with reservation. Our sentiment in the matter is rather of wonder that the Americans took three hours to sink the Spanish ships than in the direction of considering them as having won laurels. There was really no opportunity; it was like our bombardment of Zanzibar.

Turning to other matters, those who desire to hear of a naval fight in the Atlantic, and learn how many interesting problems get solved by the ordeal of war, are gradually losing all hope in the matter. There is a growing feeling that, if there is a battle, Spain will throw away what chance she may have; but there is a still stronger suspicion that presently the missing squadrons will turn up at Cadiz and anchor there. Before these lines are in print events may give them the lie, but the odds are against it. Everything points to the war being but a replica of the Chino-Japanese struggle, save that, unlike the Chinamen, the Spaniards have not even the virtue of being able to shoot fairly straight.

Meanwhile the Americans are preparing to invade Cuba, and without much undue anxiety as to the enemy's "fleet in being." Theoretically rash as this movement is, disastrous as it may well prove to their troops, practically it can be commended in that it at least holds out the possibility of being able to tempt the Spanish ships to cross the Atlantic and face a battle. But if the Americans intend to keep their warships scattered in separate and non-homogeneous squadrons, the risk run may come to be a very real one. The Spanish armored cruisers, all equal in speed, endurance, seaworthiness, gun power and armor, possess a great advantage in being so homogeneous, and the advantage is no light one. True, it is counterbalanced by defects of personnel; but it is early yet to assume that every Spanish commander is an imbecile.—Engineer.

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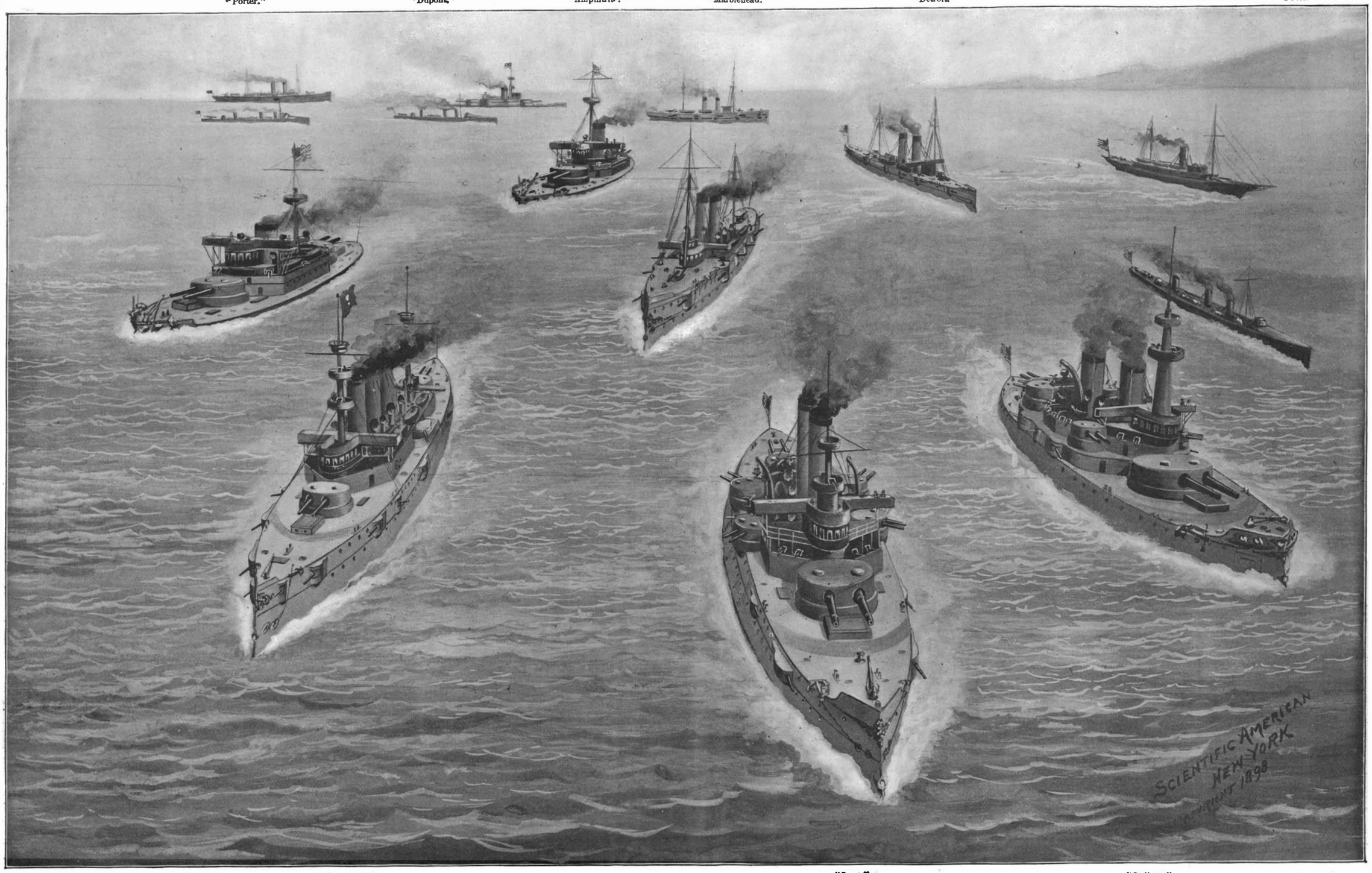

ADMIRAL SAMPSON'S FLEET OFF THE NORTH COAST OF CUBA.

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THE SITUATION AT SANTIAGO DE CUBA.

With Admiral Cervera's fleet in the land-locked harbor of Santiago and Commodore Schley's battleships guarding the narrow entrance, the naval campaign in the West Indies has lost all the complexity which has characterized it during the past few weeks—or ever since the Spanish cruisers turned up unexpectedly at Martinique. From the time when Cervera sailed, supposedly with full bunkers, from Curacoa to the day when he was definitely located at Santiago, the movements of our fleets have been directed to the location and destruction of his ships. It was naturally expected that he would make for Cienfuegos, where he would be in close touch by rail with Havana and could ship the supplies of war material which he was reputed to have on board, to General Blanco. At the same time it was realized that he might attempt to make Havana, either by running through the Windward Passage and proceeding along the northern coast of Cuba or by doubling Cape San Antonio and attempting to run in from the east. In order to intercept the fleet or shut it up in Cienfuegos, Admiral Sampson divided his ships, sending Commodore Schley around the western end of the island, while he himself went to the Windward Passage.

Contrary to expectations, Cervera made for the nearest Cuban port, Santiago. Why he should have done so is a question that is puzzling in the extreme. The stores of coal at that point are not large, it has no connection by rail with Havana, and the fact that the eastern half of the island is practically controlled by the insurgents will render it difficult for him to communicate with General Blanco, and absolutely impossible for him to send him any supplies of war material, supposing that he has them on board. It is not unlikely, however, that some of the ships are greatly in need of repairs. The Spaniards are notoriously bad engineers, and after a cruise of many weeks, engines and boilers probably called for attention that could only be given in the shelter of a home port.

Santiago de Cuba is situated on the south coast of the island, about one hundred miles from its extreme eastern point. The harbor is an ideal refuge, the approach being unusually narrow and tortuous and lying between lofty hills which on both sides are surmounted by fortifications, upon which, according to the latest information, strong batteries of modern Krupp guns have been mounted.

The entrance channel, three miles in length, is not only tortuous but it is said that its available width has been narrowed down to about one hundred feet by sinking obstructions on either side of it.

The captain of a ship which sailed from Santiago on May 13, reports that the channel has been carefully mined, a statement which is incidentally confirmed by the fact that a large quantity of high explosives and submarine mining material was shipped to Santiago last January and unloaded at the government wharf.

The accompanying map shows the great natural strength of the harbor, resulting from its difficult entrance and the excellent conditions for defense. To the right of the entrance is the inevitable Morro Castle, old fashioned, as all such Cuban forts are, and incapable of resisting the modern rifles carried by our ships. Two batteries and a fort also command the entrance from the eastern shore, while on the western shore, at the immediate entrance, is another battery. The fact that the channel is narrow, winding, and sown with torpedoes, coupled with the short range, plunging fire to which a fleet attempting to force a passage would be exposed, would render the task of entering the harbor extremely perilous. An attempt to countermine the channel would probably be disastrous, as the small boats which undertook it could be swept at close range by a murderous fire from the guns of the forts—even the obsolete smoothbores would be effective for this work, using grape and shell.

In spite of its natural strength, however, there is little doubt that Commodore Schley's fleet, provided the draught of his ships would allow it, would be equal to the task of countermining the channel, running by the forts and successfully engaging the fleet in the harbor; but the victory would be dearly won both in ships and men, for it is too much to hope that Cervera and Santiago are as poorly prepared as were Montojo and Manila in the Philippines.

With Cervera actually shut up in Santiago we have gained a strategic point of great importance, which could only be surpassed by the complete destruction, or better yet the capture, of every vessel in the fleet. The capture of the fleet would mean the addition to our navy of four fine ships of just the very type in which we are deficient, to say nothing of two of the largest and swiftest torpedo boat destroyers in existence. There are two ways in which the capture of the fleet intact might be effected. We might keep a fleet of overwhelming superiority off the harbor entrance until the close of the war, or we might make a combined assault by sea and land on the forts at the entrance and, after they had been captured, close the narrow channel by sinking stone-laden vessels or barges in the channel. The Spanish fleet would thus be effectually trapped in the upper bay, and would be ours at the close of the war.

The second plan is the better, judged from any point of view. The blockade of the harbor would necessitate our keeping idle a fleet superior to Cervera's, and our navy would be proportionately weakened for operations elsewhere. On the other hand, if we landed troops on each side of the entrance and made a simultaneous assault by sea and land, we could undoubtedly silence and capture the forts and effectually seal up the harbor. Our small boats could then remove the mines, and the hulks could be towed into the channel and sunk in positions where any attempt on the part of the enemy to remove them would be subjected to a concentrated fire from the forts, now in our possession. With the entrance in our hands and the channel effectually closed, there would be no necessity to keep a blockading fleet off the harbor, and the whole of Sampson's fleet would be available for the reduction of Havana and San Juan or the destruction of the Cadiz fleet, should it venture across the Atlantic.

It has been suggested that the Spanish admiral would destroy his ships rather than allow them to fall into the hands of the enemy; but we doubt very much if the Spanish government, in view of the indemnity demand which is sure to follow the close of the war, would voluntarily reduce its assets by from fifteen to twenty million dollars in the destruction of the fine ships which compose Cervera's squadron. But even if the ships should be destroyed, the Spaniards would merely be doing a work which, if we attempt it outright, will probably cost us many lives and serious damage to the vessels of our squadron.

THE HARBOR OF SANTIAGO DE CUBA.

Now that the "Oregon" has successfully completed her remarkable 14,000-mile journey from the Pacific station, we have gathered in Cuban waters a great fleet of over seventy vessels, undoubtedly the most powerful aggregation of American warships ever drawn together upon the high seas. It includes all of our battleships, four of the monitors, the two armored cruisers, a whole fleet of protected cruisers, most of the gunboats, the torpedo flotilla, the converted yachts, a fleet of colliers, a hospital ship, water supply vessels, dispatch boats, converted tugs and all the etcetera in the way of craft that goes to make up a great fleet engaged in the blockade of an enemy's ports.

A representative squadron of these ships is shown in the accompanying full-page engraving, which represents Admiral Sampson's squadron, reinforced by two or three cruisers, after its return from the bombardment of San Juan. The point of view is such that the eye is able to take in every gun on the battleships; and it must be admitted that the term "bristling with guns," which was so frequently used in describing the old wooden three-deckers of a bygone day, is applicable to the heavily armed battleships of our navy. This effect is particularly noticeable in the "Iowa," the largest vessel in our navy, and it will be noticed that she is capable of concentrating an extremely powerful fire either ahead or astern or on either broadside. She is a later ship than the "Indiana," and shows her superiority to good advantage in the illustration. She is provided with a forecastle or spar deck, which has the effect of increasing her freeboard by some 7 or 8 feet. Her forward pair of heavy guns is carried above this deck at a height of over 26 feet above the water, and hence they have a fine command. The 12-inch guns, being at the same level as the 8-inch guns, which are carried in four turrets amidships, the blast of the 8-inch does not interfere with the big weapons when the former are fired dead ahead or dead astern. The "New York" is another favorite ship in the navy, and on account of her roominess and superior quarters, she has done more duty as a flagship than probably any other ship in the navy. The "Indiana," a veritable bulldog of war, is a sister ship to the "Massachusetts" and the "Oregon." Her 13-inch guns are more powerful than the 12-inch weapons of the "Iowa," but sitting so much lower in the water, she does not carry them so well nor keep them so dry in bad weather as the latter ship. The "Terror," "Amphitrite" and "Puritan" are responsible for the slow speed made by Sampson's fleet on its cruise to San Juan; but their 10 and 12-inch guns enabled them to redeem themselves when they came tardily upon the scene of battle. The "Detroit," "Marblehead" and "Montgomery," with their splendid batteries of ten 5-inch rapid-firers, are very effective ships of their class. They have already made themselves heard in the war and will doubtless be frequently heard from again before it is over. The "Porter" and "Dupont" are our fastest torpedo boats, with a respective speed of 28·6 and 28·5 knots, and the "Foote" is credited with 24·5 knots per hour. The "Mayflower," formerly Mr. Goelet's yacht of that name, is a gunboat of 1,475 tons and over 18 knots speed, and in the far distance is seen the "St. Paul," whose speed of 21 knots and great coal capacity render her capable of scouting far from the fleet and bringing early tidings of the movement of the enemy. The total displacement of this fleet is about 69,000 tons, and it includes the following armament of heavy guns: Four 13-inch, eight 12-inch, eight 10-inch, twenty-two 8-inch, four 6-inch, thirty-two 5-inch and twenty-six 4-inch, in addition to which there is an innumerable battery of 6-pounders, 1-pounders and machine guns.

Robert Fulton's Torpedoes.

Before he turned his attention to navigation by steam, Robert Fulton invented a marine torpedo which he endeavored to dispose of to the United States government. Succeeding in interesting James Madison, then Secretary of State, in the matter, he obtained a small appropriation from the government for the purpose of conducting some public experiments. In the summer of 1806 he invited the high dignitaries and a number of prominent citizens of New York to Governor's Island to see the torpedoes and machinery with which his experiments were to be made. While he was lecturing on his blank torpedoes, which were large, empty copper cylinders, his numerous auditors crowded around him. After a while he turned to a copper case of the same description, which was placed under the gateway of old Castle William, and to which was attached a clockwork lock.

Drawing out a peg, Fulton set the clock in motion, and then he said in solemn tones to his attentive audience: "Gentlemen, this is a charged torpedo, with which, precisely in its present state, I mean to blow up a vessel; it contains one hundred and seventy pounds of gunpowder, and if I were to suffer the clockwork to run fifteen minutes, I have no doubt that it would blow this fortification to atoms."

The circle of humanity which had closed around the inventor began to spread out and grow thinner, and before five of the fifteen minutes had passed there were but two or three persons remaining under the gateway. Some, indeed, lost no time in getting at the greatest possible distance from the torpedo, and they did not again appear on the ground until they were assured that the engine of destruction was safely lodged in the magazine, whence it had been taken. The local historian of that period remarks:

"The conduct of Mr. Fulton's auditors was not very extraordinary or unnatural; but his own composure indicated the confidence with which he handled these terrible instruments of destruction and the reliance he had on the accuracy of the performance of his machinery. The apprehensions of his friends surprised and amused him, and he took occasion to remark how true it was that fear frequently arose from ignorance."

IN a report presented recently to the Central Railway Club, appointed to inquire into the question of standardizing steel coil springs, used for freight cars, the following was recommended, says The Mechanical Engineer, as the chemical composition: Carbon, 1·00 per cent; manganese, 0·25 per cent; phosphorus, not above 0·05; silicon, not above 0·10; sulphur, 0·03.

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Havana Tobacco in Florida.

The almost total suspension of industries in Cuba has ruined one of the most important tobacco centers of the world, and Havana cigars will soon become a misnomer if something is not done shortly to revive business in that unfortunate island. Nearly every tobacco plantation in the famous Vuelta Abajo district is in ruins to-day, and, as little more than a tenth of the normal crop was obtained from that district in 1897, the world's supply of choice Havana tobacco is very small. It is estimated that it will take from ten to twenty years for the Vuelta Abajo district to recover its normal condition again, and probably it may never reach its former flourishing lead in the tobacco world. The plants, and consequently the seeds of the particular brand that made this district famous, have all been destroyed, and it will require years of careful cultivation to establish new plants equal to the old.

Meanwhile, Florida and other States of this country have profited by Cuba's war, and the tobacco industry has been transferred to American soil. For several years now tobacco growers have been gradually withdrawing from Cuba, and establishing themselves in different parts of Florida, anticipating the final destruction of all plantations and property in Cuba. They brought with them the seed of the tobacco plants raised for ages in the Vuelta Abajo, and, where the conditions proved favorable, plants nearly equal to those raised around Havana have been established. The soil of many parts of Florida is identical to that around Havana, and the moisture needed is supplied by spraying or irrigation.

Secretary Wilson, of the Agricultural Department, has directed special attention to the study of the new tobacco plantations in Florida, and experts of the department do not hesitate to say that they believe Florida can produce as good tobacco as any ever raised in Cuba. In fact, such good results have already been accomplished. Of the millions of Havana cigars sold in the United States to-day, over 50 per cent are made of tobacco raised in Florida. One peculiarity of the industry in this country is that the plants show a tendency to degenerate, and in order to keep up the quality of the best grades, it is necessary to secure seeds from outside sources. Heretofore the Florida growers have imported their seed annually from Cuba, and it is feared that, if that source of supply is cut off in the future, the present high quality of Florida tobacco cannot long be maintained. But with Vuelta Abajo as a great seed farm, the Florida planters never had any reason to expect any deterioration in their goods.

The Cuban cigar makers and tobacco curers have followed in the footsteps of their industry, and Florida to-day employs on her tobacco plantations and in her cigar factories more expert Cuban workers than in all Cuba. Finding their industry ruined at home, they emigrated to Florida, and at Key West and Tampa they throng the streets, and contribute their knowledge toward the building up of the finest tobacco plantations and factories in the world. Florida is not yet by any means near the head of our tobacco producing States; but the quality of her tobacco promises to lead in the long run. In short, every effort is being made to place her in such a strong position that no amount of rivalry will ever ruin her rapidly increasing industry. When Cuba finally rises out of the ashes of her sorrow, she will find a strong competitor in Florida in the tobacco markets of the world.

There are nearly forty varieties of tobacco known to growers, but of these only a few are worthy of cultivation. That raised in the district around Havana is considered the best, but the soil, climate and method of curing the leaves affect the quality to a greater or less extent. Connecticut, Massachusetts, New York and Pennsylvania raise what is called Havana tobacco, that is, tobacco plants that have been grown from imported Havana seed, but this is not by any means similar to the fine tobacco that the Cubans roll into cigars in the Key West and Havana factories. Similarly, Sumatra tobacco is grown in a dozen different States in this country, and the leaves make pretty good wrappers, but the pure Sumatra is still largely imported from the island that gives it the name. The mysterious influence which climate and soil has upon the tobacco plants is beyond the comprehension of botanists and practical growers. All that can be done is to find soil and climate as similar as possible to those found in the plant's native country, and then try to supply artificially certain other conditions.

One of these conditions is more rainfall and a moister climate. Irrigation supplies in Florida all the water the plants need around their roots, and now artificial spraying is being experimented with to see if it will supply the leaves with an imitation rain. During the rainy season in Cuba the tobacco plants are drenched most of the time. This may have a direct bearing on the quality of the tobacco plants. Another question calling for solution is that of curing. The leaves in curing go through a process of fermentation, and as this is caused by the activity of certain bacteria, it is possible to control it if the right kind of bacteria could be employed. One theory is that the flavor of the tobacco leaves is largely due to the bacteria, and that each species produces a quality peculiarly its own. This is only another way of saying that the climate effects the curing of the tobacco, for the species of bacteria that would thrive in the Cuban climate might not be able to exist in Connecticut. However, experts from the Department of Agriculture are investigating the subject, and if it can be proved that the peculiar flavor of the Havana tobacco is partly due to bacterial fermentation, efforts may be made to introduce the particular species found in the Vuelta Abajo district in Florida. The little organisms might be artificially cultivated and good results be obtained from them.

In respect to tobacco culture, the United States stands foremost of all countries of the world, and statistics compiled up to the beginning of the present year show that we supply about one-quarter of the 1,000,000 tons annually produced. Last year our exports of tobacco amounted to 281,174,422 pounds of leaf tobacco, 5,000,000 pounds of plug, 900,000,000 cigarettes and nearly 2,000,000 cigars. These exports went to all parts of the world. The Dutch are the leading consumers of tobacco in proportion to population, with Belgium second and Turkey a close third, with the United States fourth on the list. The Germans consume about 75,000 tons of tobacco a year; France, 40,000; and Great Britain, only 25,000 tons.

All sorts and grades of tobacco are raised in this country, and, as the world demands all sorts and conditions of the weed, we can supply the trade in all particulars. England, for instance, wants a strong, navy plug tobacco, and Virginia produces an article well suited to the taste. A strong, heavy, but better flavored smoking tobacco is in demand by such countries as Algiers, Morocco and Tunis, and considerable of our exports eventually go there to be made up into cheap cigars. Spain and France require a mild and well flavored article for their cigars and cigarettes, and our merchants are not slow to cater to their needs.

The tobacco district of the United States is a variable one. Years ago it was supposed that the weed could be raised successfully only in the Southern States; but gradually one State after another has taken up its culture, until more or less is raised in every State of the Union. In fact, some of our Northern and Eastern States, which were formerly considered unsuitable for tobacco growing, lead some of the old tobacco States in the quantity, if not in the quality, of tobacco raised annually. Kentucky headed the list in 1897, with North Carolina second and the other States in the following order—Virginia, Tennessee, Ohio, Maryland, Pennsylvania and Wisconsin. Connecticut and New York stand tenth and fourteenth respectively on the list.

Nearly all of the tobacco raised in Cuba was either made up in cigars at home or shipped direct to the United States, and in recent years American capital controlled most of the trade on the island. Tobacco buyers from this country went down to Cuba before the harvesting season, and often bought the crop before it was picked. These buyers represented an army of experts who could distinguish one grade from another with little difficulty. They tested the leaf by the smell, by the ashes and by smoking it. A slight variation in leaves obtained from the same plantation would condemn the whole crop in the eyes of the buyer. Tobacco that would not hold its fire when rolled up as a cigar would also come under the rule of condemnation, but tobacco that would burn three or four minutes without going out would pass for extra good cigar material. G. E. W.

The Current Supplement.

The current SUPPLEMENT, No. 1170, contains a number of articles of more than general interest. "The Fortifications of Manila" is the title of an illustrated article which will prove of great interest in view of the recent reduction of these fortifications by Commodore Dewey. "Kites: Their Theory and Practice," by Capt. Baden-Powell, is a practical article on the manufacture and methods of flying kites both singly and in tandem. This will prove very useful to our readers, who frequently ask for a practical article on this subject. "An Electrical Bureau" is the subject of an address before the International Association of Commissioners and Inspectors of Buildings. It advocates an efficient electrical bureau to supervise new and old installations of wire, motors, etc. "The History of the Stone Arch," by Prof. M. A. Howe, is the beginning of an important paper illustrated by 12 half tone engravings showing famous stone arches. "Five Early Astronomers" gives an interesting biographical account of Copernicus, Tycho Brahe, Kepler, Huyghens and Galileo Galilei. "American Competition with France in Agricultural Products" gives important economic information. "The Governmental Department of Science" is advocated by Prof. J. H. Gore.

TO BLACKEN ZINC SURFACES.—According to the Decor. Gaz. the zinc article is dipped in a weak solution of copper sulphate; it is then dried by moderate heating, rubbed off well with a dry cloth rag, and finally wiped with a flannel rag upon which a few drops of olive oil have been poured.

Prof. Dewar Liquefies Hydrogen.

Prof. Dewar has recently liquefied hydrogen, which is an unprecedented feat. This invention was announced by cable to The New York Sun on May 11, and now fuller accounts of his experiments have been published. There is already controversy as to where the credit belongs for first bringing this element into control. The Polish scientist Olszewski forestalled the discovery a year or two ago by accurately determining the critical temperature and boiling point of hydrogen, but he did not succeed in reducing the gas to a liquid form in a really practical way, so that it could be examined and its properties tested. This has been done for the first time by Prof. Dewar, and most interesting are the disclosures which are certain to result from experiments made at the extremely low temperature of —205 degrees Centigrade. Prof. Dewar has explained his latest researches at a meeting of the Royal Society, and his discoveries were received with extraordinary interest. Two or three years ago Prof. Dewar showed how a jet of hydrogen could be used to cool bodies below the temperature that could be reached by the use of liquid air, but all attempts to collect the liquid in vacuum experiments failed.

The type of apparatus used in these experiments worked well, and it was therefore resolved to construct a much larger liquid air plant, and to combine with it circuits and arrangements for the liquefaction of hydrogen. A start was made with hydrogen cooled to —205° Centigrade, and under a pressure of 180 atmospheres, escaping continuously from the nozzle of a coil of pipe at the rate of about 10 or 15 cubic feet per minute, in a vacuum vessel, double silvered and of special construction, all surrounded with a space kept below —200° Centigrade. Liquid hydrogen began to drop from this vacuum vessel into another, doubly isolated by being surrounded with a third vacuum vessel. In about five minutes 20 cubic centimeters of liquid hydrogen were collected, when the hydrogen jet froze up from the solidification of air in the pipes. The yield of liquid was about one per cent of the gas. Five gallons were produced in an hour. Hydrogen in the liquid condition is clear and colorless, showing no absorption spectrum, the meniscus being as well defined as in the case of liquid air.

The liquid must, in Prof. Dewar's opinion, have a high refractive index and dispersion, and the density must be in excess of the theoretical density—0·18 to 0·12—which we deduce respectively from the atomic volume of organic compounds and the limited density found by Amagat for hydrogen gas under infinite compression. Prof. Dewar's old experiments on the density of hydrogen in palladium gave a value of 0·62 for the combined body. Not having arrangements at hand to determine the boiling point, he made two experiments to prove the excessively low temperature of the boiling fluid. In the first place, if a long piece of glass tubing, sealed at one end and open to the air at the other, is cooled by immersing the closed end in liquid hydrogen, the tube immediately fills with solid air where it is cooled. The second experiment was made with a tube containing helium—a rare gas which has hitherto resisted all attempts to effect its liquefaction.

Two years ago, arguing by analogy of the molecular weights of fluorine and oxygen, Prof. Dewar suggested that the volatility of hydrogen and helium would probably be found close together. A specimen of helium which had been extracted from Bath gas was sealed in a bulb with a narrow tube attached, and was placed in liquid hydrogen, when a distinct liquid was seen to condense. From this result it would appear that there cannot be any great difference in the boiling points of helium and hydrogen. All known gases have now been condensed into liquids which can be manipulated at their boiling points under atmospheric pressure in suitably arranged vacuum vessels. With hydrogen as a cooling agent we shall get within 20° or 30° of the zero of absolute temperature. No one can predict the properties of matter under zero of temperature. Faraday liquefied chlorine in the year 1823. Sixty years later Wroblewski and Olszewski produced liquid air, and now, after fifteen years' interval, the remaining gases, hydrogen and helium, appear as static liquids.

The Whitehead Torpedo.

The Whitehead torpedo, of which we may hear frequently in the next few weeks, is 16 feet 5 inches long, 17·7 inches greatest diameter, and weighs, ready for service, 1,160 lb., says Engineering News. It carries 220 lb. of wet guncotton at a speed of about 28 knots per hour, and at that speed it has a range of about 850 yards. This torpedo is built of steel and is propelled by two two-bladed screws, revolving in opposite directions on the same axis, to neutralize the rolling tendency of the torpedo. The screws are operated by a three-cylinder engine driven by air compressed to 1,350 lb. per square inch; and an intricate apparatus, called the Obry gear, is used to automatically keep the torpedo pointed straight during the run. The Obry gear is essentially a gyroscope controlling the valves of the steering engine, which operates two rigidly connected vertical rudders.

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VACUUM ILLUMINATION AT THE ELECTRICAL EXHIBITION.

Modern electric lighting by means of arc and incandescent lamps is the outgrowth of discoveries made over a half century ago; and while the progress in electrical matters made since the business began to assume a commercial character is little short of wonderful, it seems almost unaccountable, in the light of what is known, that the grand electrical awakening was so long delayed.

Vacuum tube electrical lighting is almost a parallel case. The vacuum tube itself is not a new thing; it has long been known that it could give considerable light, but it is only very recently that anyone has had courage enough to undertake to reduce vacuum tube lighting to a practical form and render it available for everyday uses.

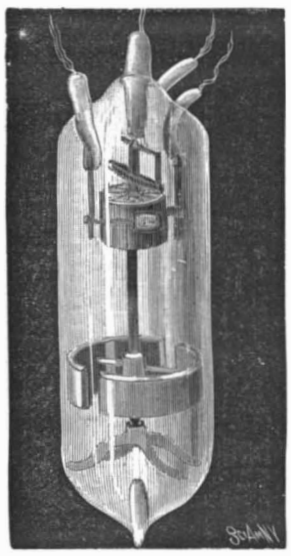

Fig. 2.—VACUUM TUBE OF RAPID CIRCUIT BREAKER.

At the Electrical Exhibition in this city was shown a Gothic chapel of fair size furnished with pews, a pulpit and full-sized organ. It was carpeted and furnished with stained glass windows and illuminated in a novel and attractive manner by a new and successful system of vacuum tube lighting invented by Mr. D. McFarlan Moore. Mr. Moore has been perfecting this system for some years, as will be seen by an examination of the files of the SCIENTIFIC AMERICAN. The exhibit embodies his improvements and gives an excellent idea of the practical value of this system. The windows are screened so as to exclude external light, thereby giving the observer the exact value of vacuum tube illumination. The vacuum tubes are about two inches in diameter and of sufficient length to reach from the pilasters to the apex of the ceiling. They are bent to conform to the curvature of the Gothic arches and their upper ends abutted against straight tubes extending along the highest part of the ceiling, all being mounted in neat, specially designed fixtures. Over the arched front door of the chapel were arranged vacuum tubes, in the form of letters, which spelled out the legend Moore's Vacuum Tube Chapel. The light within was soft and diffusive, having the color of daylight. The tubes were connected up in parallel, and the current used was the "kick" or extra current derived from simple coils without magnetic cores, and not from the secondary wires of an induction coil, as is generally supposed.

The secret of success lies in the use of a circuit breaker which completes and breaks the circuit 60,000 times a minute; but great rapidity in the breaks is not the only feature of the circuit breaker. Mr. Moore has placed the entire circuit-breaking mechanism in a vacuum tube, as shown in Fig. 2, in which a high vacuum is maintained. By this construction sparks are avoided and the instantaneous break depended upon for efficiency is secured.

The rapid circuit breaker is operated by a Gramme ring surrounding the tube, as shown in Fig. 3, and forming the field magnet of the motor which breaks the circuit, the armature being attached to the commutator of the circuit breaker. The breaker is connected with the Edison three-wire system, a simple coil being inserted in each of the leads.

No perceptible heat is given out by the tubes, and it is believed that this is the nearest approach to the production of light without heat that has been made.

From what has been said it will be seen that this system of lighting is adapted to the present commercial circuits—a great point in its favor. This system in its present stage of development has an efficiency about equal to incandescent lamp lighting, but it is believed experiments now in progress will show an efficiency far in advance of that already secured.

By changing the gases in the tubes, and by varying the degree of exhaustion, the color of the light may be varied for decorative purposes. Instantaneous photographic portraits have been made by this light, and it is believed photographers will find vacuum tube lighting of great utility in the absence of sunlight.

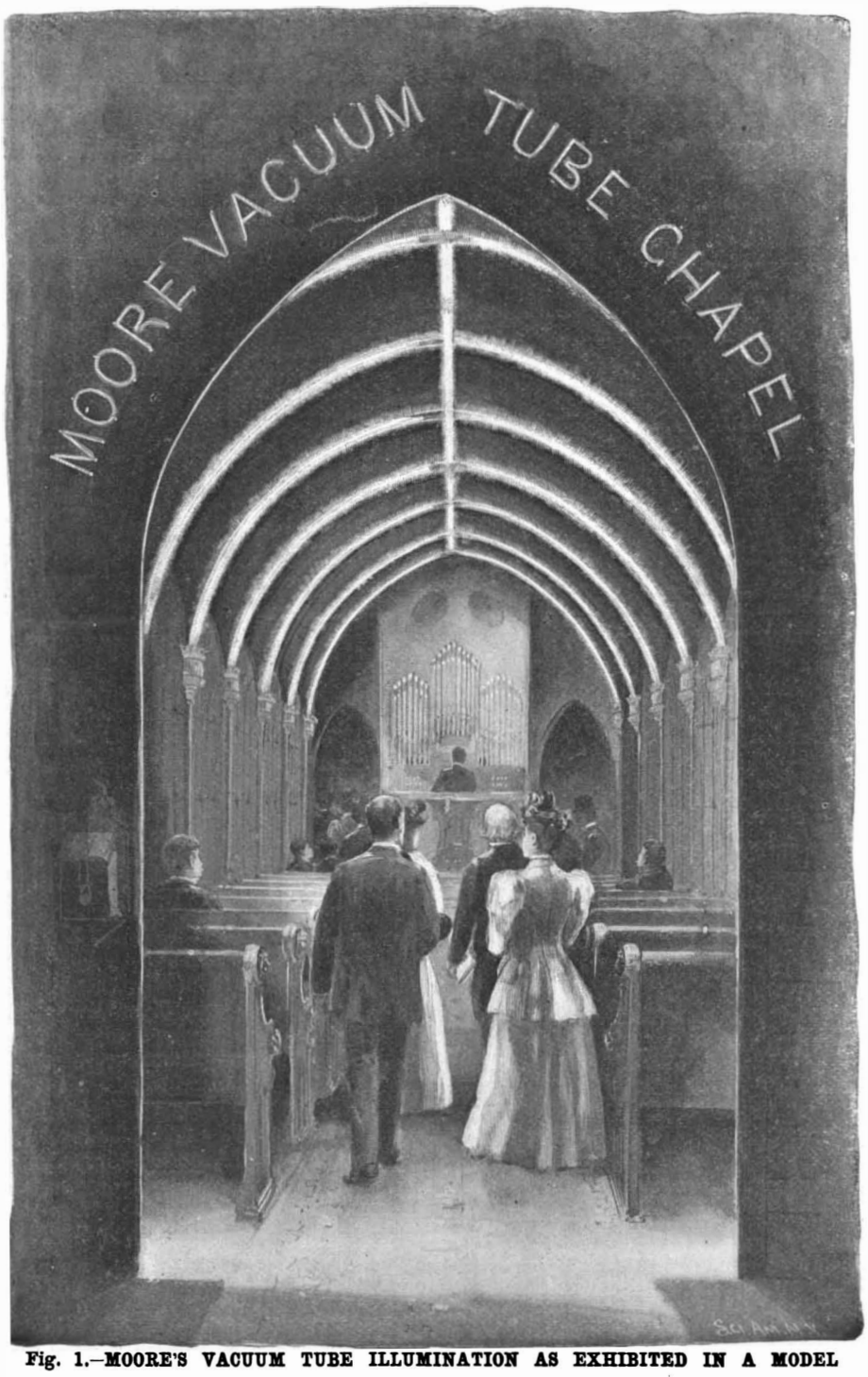

Fig. 1.—MOORE'S VACUUM TUBE ILLUMINATION AS EXHIBITED IN A MODEL CHAPEL.

Strength of Elephants.

Not much information respecting the strength of elephants has ever been placed before the public, hence the interest which attached itself to the tests made some days ago upon two elephants belonging to Messrs. Barnum & Bailey at Olympia, London, says The Engineer. Unfortunately for the trials, the large elephant Mandarin, who weighs somewhere about four tons, could not be induced to put the whole of his strength into the experiments, and succumbed ignominiously to the small elephant Bébé. The measuring instrument was a tractometer lent by Messrs. Thornycroft, of Chiswick, and registering up to 30 tons. The tractometer was placed on a small trolley and attached at one end by means of ropes to half a dozen holdfasts driven into the earth of the arena. The first animals tested were a pair of powerful draught horses, which are considered capable of hauling on a wagon on an ordinary road from 8 to 9 tons. Yoked by means of whiffletrees to the tractometer, they only pulled 1·2 tons. The elephant Mandarin had the ropes leading to the measuring instrument passed round his forehead, and he ran the indicator up to 1·85 tons. In a second attempt the force indicated was 2·5 tons. The small elephant was next

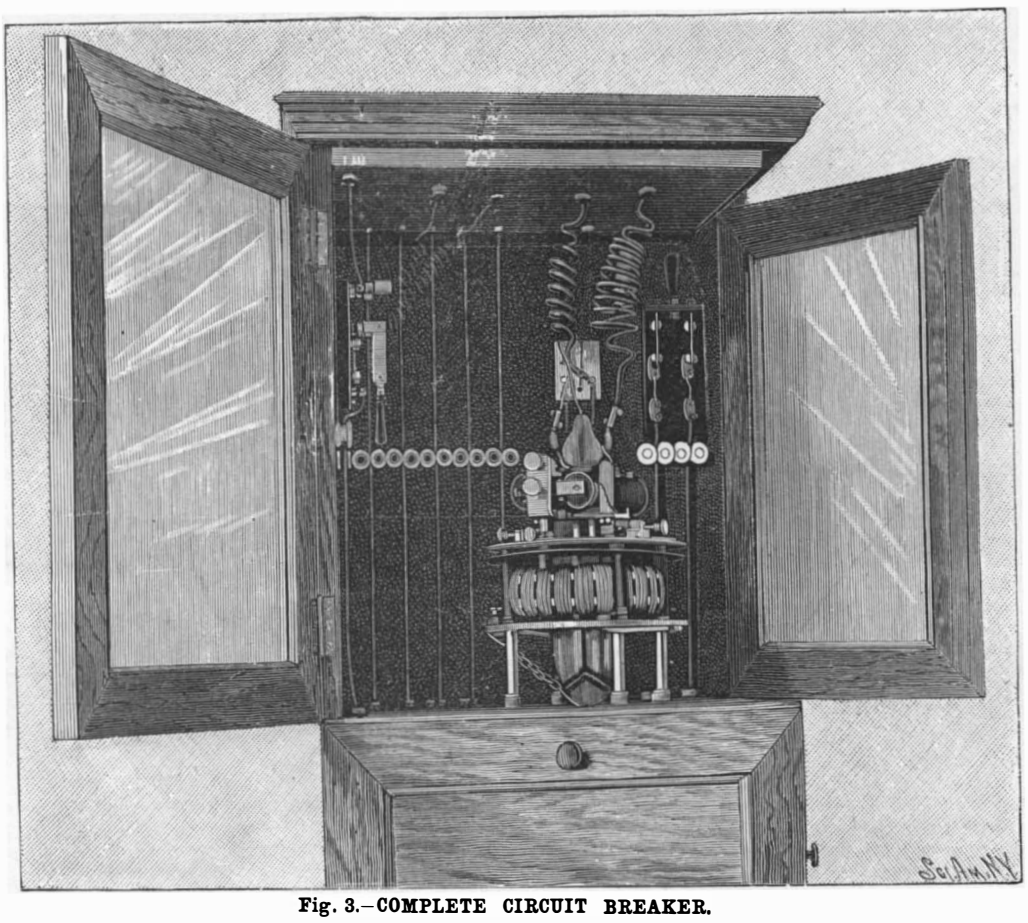

Fig. 3.—COMPLETE CIRCUIT BREAKER.

put to it, and she in her first attempt exerted a force of 5½ tons. After that she shoved, with her head resting on the tailboard, a heavy wagon round the whole arena. This task she did with great ease, although the wagon contained no fewer than fifty-eight men, and was, all told, of an estimated weight of 5 tons. Man had then his turn. Some eighty-three of the show hands were put on to the ropes attached to the tractometer, and pulled against it as in a tug-of-war. With a pull of 2·7 tons the rope broke and precipitated the whole crowd of men to the ground. It was attached afresh, and again broke, this time at 3·2 tons. With a new rope the attempt was again made, when a resistance of 5·6 tons was overcome.

Formation of Chlorophyl.

W Palladine finds that oxygen is essential for the reproduction of the green color in etiolated leaves, and in greater quantity than is necessary for respiration. Thus when leaves which had been etiolated for forty-eight hours in the dark in a 10 per cent solution of saccharose were exposed to the light, immersed in water in a test tube, it was found that the green color was restored most rapidly to those leaves which were in the upper part, in contact with the air, although the light was equally distributed over the whole length of the tube.

The action of solutions of various carbohydrates on the formation of chlorophyl was also experimented with. Thus leaves almost entirely free from carbohydrates were obtained by etiolating them in boiled water. A portion of these, when exposed to light, still immersed in water, showed scarcely any development of chlorophyl. When immersed in a 10 per cent solution of saccharose, however, an intense green color was developed; raffinose in a 5 per cent solution acted in a similar manner. Dextrose and fructose gave rise to the green coloration somewhat more slowly, and with galactose, for the first five days, the leaves showed no color; after then the color developed very rapidly. Dulcite solution, mannite, asparagin, urea, alcohol and ammonium hydrochloride prevented the formation of chlorophyl, while inulin and tyrosin appear to be neutral in their action.—Comptes Rendus.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.--William S. Sutton, Belvidere, Ill. This rotary engine comprises a casing, a shaft extended through the casing, pistons mounted on the shaft, but isolated one from the other, each piston comprising a cylinder or hub portion and a radial wing, an abutment wheel for each piston, each abutment wheel consisting of a hub portion having inlet and outlet ports and radial blades, means for controlling the admission of steam through the ports, disks mounted on the hub portions of the abutment wheels, the disks being provided with radial slots, dogs pivoted in the casing, there being two dogs for each disk, the dogs having fingers to engage in the slots of the disks and means for moving the dogs into and out of engagement with the disks.

ROTARY ENGINE.—Thomas C. Luce, Richmond, Mass. This rotary engine comprises a cylinder, semi-circular in cross-section, a slide-valve for governing admission of steam, a regulating valve movable with and adjustable relatively to the slide-valve, an abutment movable in the cylinder, a semi-circular piston in the cylinder comprising a center block and side pieces, segmental packing strips between the side pieces and adapted to engage against the sides of the cylinder, springs for forcing the segmental packing-strips outward, a packing-strip made in two sections and arranged between the side pieces at the end of the piston, a spring exerting longitudinal pressure on the sections and a spring for forcing the sections outward.

ROTARY ENGINE.—Augustine N. Gilbert, Berlin, N. H. This improvement in rotary engines consists essentially in two parallel shafts having cylinders or drums placed thereon and connected by a chain passing over the same. To the chain are attached bars extending parallel with the direction of the drums and forming piston heads. This chain and the drums are surrounded by a casing which forms the cylinder, and the device is provided with suitable inlet and exhaust ports and valves and with devices for moving the abutment plates.

ENGINE CONTROLLING DEVICE.—Alexander P. Loper, Stonington, Conn. The purpose of this invention is to provide an engine controller especially designed for use on steamers to enable the pilot to stop, start or reverse the engines and to run them at any desired speed. The invention consists of an auxiliary cylinder containing a piston connected with the throttle-valve and with the reversing gear of the engine for actuating both simultaneously, and a valve directly under the control of the pilot and connected with a supply and with the ends of the auxiliary cylinders to shift the piston therein in the desired direction.

Mechanical Devices.

PULVERIZING ATTACHMENT FOR CULTIVATORS.—Gilbert G. Gilbertson, West Mitchell, Ia. In this pulverizing attachment for cultivators and like implements, are provided a head, tines carried thereby and means for adjustably connecting the head with the beam of the implement. A clamp comprising cross bars is connected at one end to the cultivator handles and a hanger is connected to and enters the tine portion of the attachment. A clamping screw passes through the bars of the clamp and secures the hanger. This attachment is designed to level the ridges left by the cultivator teeth or blades, and to gather rubbish and weeds and leave them exposed at the top of the grond without clogging the machine.

VEHICLE BRAKE.—René Marie Artus, Vicomte de Chivré, Gonneville, par Saint Pierre-Eglise, Département de la Manche, France. The principle of this invention is the application of a pull on a flexible connection adapted for frictional contact with the shaft, wheel, hub or other rotating part of the vehicle. The flexible connection is operatively connected to the brake proper and the friction between the connection and the rotatable part produces a tension on the connection and this tension is made use of in applying the brake. The principle may be applied to all kinds of vehicles.

COIN-CONTROLLED APPARATUS FOR DISPENSING LIQUIDS.—William P. Hackett, Winchester, Ky. This apparatus consists of a faucet, a cylinder with piston and rod connected to and operating the faucet, a compressed-air valve connected to the cylinder, a coin carrier operating the air valve, a liquid receiving and weighing device and a discharge air-valve controlling the escape of air from the cylinder, the discharge valve being opened by the movement of the liquid receiving devices. By inserting a coin into the apparatus, a certain amount of liquid is dispensed.

FARE REGISTER OPERATING MECHANISM.—Charles Bernstein, New York City. In this device a railing on the platform of a car embraces one of a pair of doors for the car, and a swinging section for the platform is located within the space embraced by the railing. A draw-rod has connection with the swinging section and a rock shaft is operated by the draw-rod. A finger extended from the rock shaft is adapted to operate the lever of the fare-register. The passenger, when boarding the car, will thus actuate the mechanism to ring up and register a fare to be collected after he has entered the car.

PROCESS OF AND APPARATUS FOR CONTINUOUSLY FILTERING AND PRESSING GARBAGE.—Charles Edgerton, Philadelphia, Pa. This process of continuously filtering the liquids from the solids in the treatment of garbage consists in distributing the slushy material in a layer upon a traveling diaphragm, and applying a hot, gaseous pressure to the upper side of the layer while it is in transit. The filtering and pressing apparatus comprises a casing, an endless filtering belt and means for closing its edges against the sides of the casing, crushing rolls at the end of the belt, a subjacent belt extending under and beyond the first named belt and having a fibrous covering and a series of parallel rollers at one end and an adjustable series of parallel rollers arranged above the first named series and carrying an endless metal slatted belt, a frame for supporting the upper adjustable series of rolls being pivoted at one end and made adjustable at the other.

CAR FENDER.—Isaac Macowsky, New York City. The object of this invention is to construct a car fender which can be lowered to the ground by the use of the ordinary brake-shaft. The connection between the fender and the brake-shaft is such that the fender may be lowered in advance of the application of the brakes, at the same time not interfering in the slightest with the operation of the brakes. To this end a pivoted fender, having a yielding support, is connected to the brake shaft, a drum being mounted to rotate and having a chain leading to the fender and frictional connections from the drum to the brake-shaft whereby the fender is depressed when the brake is applied. Means are provided enabling the fender to rise automatically from the track when the brakes are removed.

Miscellaneous Inventions.

SELF-CLOSING UMBRELLA.—Frank E. Stover, Luray, Va. In this umbrella the ribs and stretchers are connected with a runner having in its upper face seats in which the lower ends of the stretchers loosely rest. Coil springs are secured to the stretchers and to the upper portion of the runner whereby the springs serve to hold the stretchers to the runner and also to force the runner downward when released from its locking device. The usual tie-wire may be dispensed with, and the stretchers may be held in the runner by the action of the springs only.

CIGARETTE WRAPPER. — Carl Hermann Mehner, Berlin, Germany. This cigar or cigarette wrapper consists of a thin metal film, coated with a suitable innocuous substance which will induce such an action of capillarity with the metal as to prevent the transformation of the melted film into large drops.

STAKE FOR PLANTS AND TREES. — Theron N. Parker, Brooklyn, N. Y. This invention consists principally of a support made in tiers vertically adjustable one on the other, each tier having legs and a rim, the legs of one tier being slidably connected with the legs of the preceding tier. The invention further consists of a support made in sections, each formed with a leg terminating in an eye and a rim part, the free end of the latter being formed with a pin adapted to engage the eye of the adjacent section.

THAWING APPARATUS. — David Phillips, Pony, Montana. The thawing device provided for in this invention comprises an air-heater, a suction-fan for drawing air from the heater, a flexible pipe receiving the discharge from the fan, a discharge pipe having connection with the flexible pipe, nozzles on the discharge pipe, a sleeve in which the discharge pipe is axially and longitudinally adjustable, a plate having bearings in which trunnions on the sleeve engage, a block, a socket-plate on the block and with which the first-named plate engages, and a bolt passing from the first-named plate through the socket plate and through the block.

KNOCK-DOWN HOUSE.—Peter A. Tofft, New York City. This invention embodies an improvement in that class of houses intended to be readily taken apart and moved from place to place. The house is in general of a hemispherical shape and consists of vertical ribs extending from the base toward the apex and provided with grooves in their edges, and of plates which slide within these grooves and overlap one another. The parts are all divisible into small sections so that they may be readily transported.

CHAIN-LINK. — William H. Griffith, New York City. This bent-wire link has a terminal eye at one end, a loop, a bight or coil corresponding in size to and coinciding with the terminal eye and forming a duplex eye with parallel folds, a transverse wrap below the coinciding eye and bight, the link having the end eye extended and below the transverse wrap and held within its embrace.

JAR AND TEMPORARY CLOSURE THEREFOR.—Julian P. Lyon, Detroit, Mich. This invention provides for a jar which may be held closed by the pressure of the atmosphere rather than by the pressure of a clamp, although the latter is used in the first stage of preserving. A fastener is furnished consisting of resilient wire, having its end portions bent downward and inward to engage under the shoulder of an enlargement of the jar. A downwardly extending central portion of the wire presses against the top of the cover. When the contents of the jar begin to boil, the steam forces the cover up to an extent sufficient to permit the escape of steam. The vacuum thus produced causes the cover to be atmospherically pressed down, thus hermetically sealing the jar. The fastening is then removed.

Designs.

SHOE POLISHER FRAME.—Edward R. List, Odin, Ill. This design consists of a main or body portion having its middle portion and the depending ends and the upper projection extending in the direction of the length of the middle portion and having a handle-like formation at one end and a knob-like projection at the other end The middle portion is curved or arched from end to end on both sides, and the ends drop from the middle and have their inner faces formed on curves merging in the curved under sides of the middle portion.

BOTTLE CAP.—Herman Tappan, New York City. The leading feature of this design consists in a spiral rib forming the lower or base portion of the cap, the rib terminating at the lower end of a cylinder crowned by a head, the side of which bulges out, the top thereof being arched.

JARDINIERE.—William M. Green, New York City. The essential characteristic of this jardiniere consists in a semi-oval body comprising a top band and a bottom drop ornament. The band and ornament are apparently connected by a series of ribs and a bowl visible at the spaces between the ribs. The legs have flat sides, are fitted to the exterior of the body, are inwardly curved between their lower ends and the body and are outwardly curved at their lower extremities. The body is decorated with festooned chains. A platform is located between the legs.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(7442) O. S. asks: 1. If a flagpole about forty feet high, made of 2-inch gas pipes, would extend too far above a house of about twenty feet in height to be a good lightning conductor, and how far away from the house should it be placed? A. If you wish such a flagpole as this, it can be made to do duty as a lightning rod also by carrying its lower end down to a permanently wet soil and connecting it to the house by heavy iron wires. These should extend to all parts of the roof and over chimneys and gables. The pole should be as close to the house as possible. 2. Would two conductors of this kind, one each end of the house, connected at their upper ends by a heavy copper wire running from one to the other, be a safer and better conductor? A. Two rods at opposite ends of house are better than one. Use iron wire about one-eighth inch in thickness. 3. Would there be any danger of the shock killing a person in the house or stock in a barn in case the conductors were struck by lightning? A. There would not be so much danger as there would be if the house without a rod were struck. The 2-inch pipe is very much heavier than is desirable for a lightning rod. A half-inch pipe is large enough.

(7443) W. T. E. asks: Will you please answer me through your Notes and Queries and give me a good formula for a metol or eikonogen single solution developer for instantaneous and time exposure, and oblige? A. We refer you to formulas in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1050, 1107, 1152 and 1162. Price 10 cents each by mail.

(7444) L. F. T. asks: How many pounds of No. 18 single cotton-covered wire will I have to use in order to get an 8 inch spark, using 12 gage wire for primary and 20 amperes at 50 volts; also, how many pounds for 12 inch spark, using same current? A. You should not use a wire coarser than No. 36 in a secondary coil for 8 or 12 inch sparks. The current you propose using is much too heavy. No. 12 wire will not carry it without overheating in the coil. A quarter of this current in a good coil will give you a 12 to 15 inch spark. We have no data for these very large coils. The manufacturers of the best coils regard their data as trade secrets. They are not given in any work which we have at hand. A good coil, giving a 6 inch spark, was described in SUPPLEMENT, No. 1124. Price 10 cents by mail. A new book, "Radiography," by Bottone, gives much information regarding making coils. Price $1 by mail. If you follow these instructions, but double the carrying capacity of the primary by using wire with twice the cross section, you can then wind a secondary for the longer spark. All large coils are made in the manner described in the works referred to above.

(7445) F. C. V. asks: 1. Should the spools, bearing plates and hub of a dynamo be brass? A. Those parts should be made of brass, in which it is not desirable to have magnetism developed. Those which you mention are such. 2. Can the alternator be turned into a continuous current? If so, please tell me how, or refer me to any of your former papers, since we have kept on file all the SCIENTIFIC AMERICANS and SUPPLEMENTS from the first issue until the present. A. No. This machine is not intended for a continuous current machine. 3. Can the alternator be turned into a motor? A. No. 4. How strong a battery will be required to excite the field magnets? A. Four to six cells.

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MAY 24, 1898,

AND EACH BEARING THAT DATE.

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